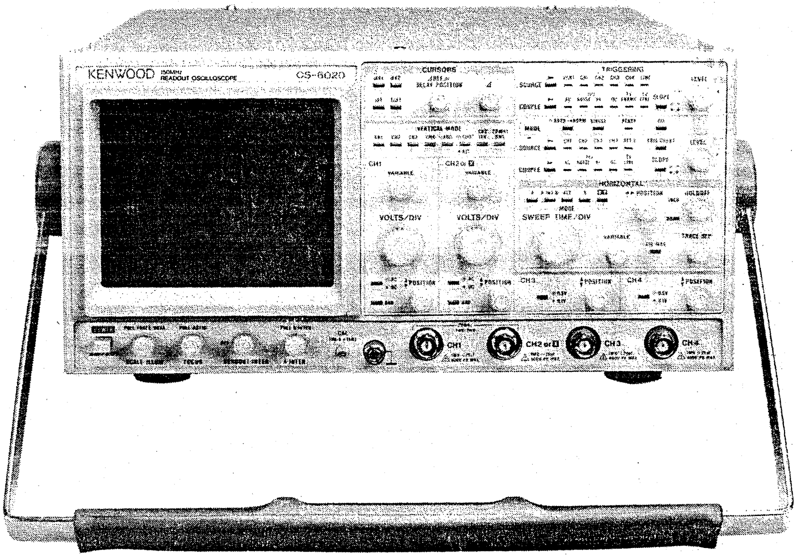
150MHz READOUT OSCILLOSCOPE

CS-6020

SERVICE MANUAL

KENWOOD CORPORATION


KENWOOD
150MHz READOUT OSCILLOSCOPE
CS-6020
CURSORS
TRIGGERING
SOURCE
COUPLE
LEVEL
VERTICAL MODE
CH1
CH2 or Y
VARIABLE
VOLTS/DIV
POSITION
HORIZONTAL
SWEEP TIME/DIV
CH3
CH4

WARNING

1. The following instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing other than contained in the operating instructions unless you are qualified to do so.

2. High voltage up to 12000 volts DC is present when the oscilloscope is operating. Line voltage (100 to 240 VAC) is present on the power transformer, on-off switch, fuse holder, and line voltage selector, any time the oscilloscope is connected to an AC power source, even if turned off. Always observe caution whether the AC plug is removed from the AC power source. Contacting exposed high voltage could result in fatal electric shock.

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SPECIFICATIONS

CRT		150 mm rectangular with internal graticule
Acceleration Voltage		20 kV
Display Area		8×10 div (1 div = 10 mm)
VERTICAL AXIS (CH1 and CH2)		
Sensitivity		5 mV/div to 5 V/div ±2% (10 °C to 35 °C) 1 mV/div to 2 V/div ±4% (10 °C to 35 °C)
Attenuator		12 steps, 1 mV/div to 5 V/div in 1-2-5 sequence Vernier control for fully adjustable sensitivity between steps
Input Impedance		1 MΩ ±1%, 20 pF ±3 pF
Frequency Response		
	5 mV/div to 5 V/div	DC; DC to 150 MHz, within −3 dB AC; 5 Hz to 150 MHz, within −3 dB
	1 mV/div, 2 mV/div	DC; DC to 20 MHz, within −3 dB AC; 5 Hz to 20 MHz, within −3 dB
Rise Time		2.3 ns or less (5 mV/div to 5 V/div) 17.5 ns or less (1 mV/div, 2 mV/div)
Signal Delay Time		More than 10 ns on the CRT screen
Crosstalk		−40 dB or less (at 1 kHz)
Operating Modes	CH1	CH1 single trace display, and dual to quad trace display in combination with other channel (s)
	CH2	CH2 single trace display, and dual to quad trace display in combination with other channel (s)
	CH3	CH3 single trace display, and dual to quad trace display in combination with other channel (s)
	CH4	CH4 single trace display, and dual to quad trace display in combination with other channel (s)
	ADD	CH1 + (±CH2) added display, and dual to quad trace display in combination with other channel (s)
	ALT	Dual to quad trace alternating
	CHOP	Dual to quad trace chopped
Channel Polarity		Normal or inverted, channel 2 only inverted
Bandwidth Limiting		Approx. 20 MHz
Chop Frequency		Approx. 500 kHz
Delay Time Difference		CH1 to CH2 ; 0.5 ns or less CH1, CH2 to CH3, CH4 ; 1 nsec or less
Non-distorted Maximum Amplitude		More than 8 div (DC to 150 MHz)
⚠ Maximum Input Voltage		800 Vp-p or 400 V (DC + AC peak)
VERTICAL AXIS (CH3 and CH4)		
Sensitivity		0.1 V/div, 0.5 V/div, ±2% (10 °C to 35 °C)
Input Impedance		1 MΩ ±1%, 20 pF ±3 pF
Coupling Method		DC coupling
Frequency Response		DC to 150 MHz, within −3 dB
Rise Time		2.3 ns or less (at 150 MHz)
⚠ Maximum Input Voltage		800 Vp-p or 400 V (DC + AC peak)
HORIZONTAL AXIS (Input thru CH2)		
Operating Modes		With HORIZ. MODE switch, X-Y operation is selectable CH1 to CH4 and ADD ; Y axis CH2 ; X axis
Sensitivity		Same as vertical axis (CH2)
Input Impedance		Same as vertical axis (CH2)
Frequency Response	DC	DC to 2 MHz, within −3 dB
	AC	5 Hz to 2 MHz, within −3 dB
X-Y Phase Difference		3° or less at 100 kHz
⚠ Maximum Input Voltage		Same as vertical axis (CH2)

SPECIFICATIONS

SWEEP			
Type	A	A sweep	
	A INT B	B sweep waveform is displayed as an intensified portion of the A sweep.	
	ALT	A sweep (intensified for duration of B sweep) and B sweep (delayed sweep) alternating	
	B	B sweep	
	X-Y	X-Y oscilloscope	
Sweep Time	A	20 ns/div to 0.5 s/div, ±2% (10 °C to 35 °C), in 23 ranges, in 1-2-5 sequence Vernier control provides fully adjustable sweep time all ranges.	
	B	20 ns/div to 5 ms/div, ±2% (10 °C to 35 °C), in 17 ranges, in 1-2-5 sequence Vernier control provides fully adjustable sweep time all ranges.	
Sweep Magnification		×10 (ten times) ±5% (A and B)	
Linearity		20 ns/div to 0.5 s/div : ±3% (±5%, at ×10 MAG)	
Holdoff		Continuously variable for A sweep from NORM to more than five times	
Trace Separation		B sweep can be separated from A sweep up to 4 divisions downward, continuously adjustable.	
Delay Method		Continuous delay, Trigger delay and Trigger count	
Delay Time		Continuous delay, Trigger delay ; 0.2 to 10 times of A SWEEP TIME/DIV set value (5,000 count fullscale)	
Trigger Count		1 to 1,000 count, Max. usable frequency;10 MHz	
Delay Accuracy		±(2% of set value +1% of fullscale)+(0 to 100 ns)	
Delay Jitter		1/20,000 (A sweep: at 1 ms/div, B sweep: at 1 μs/div)	
TRIGGERING			
A Trigger Modes		AUTO, NORM, SINGLE, FIX	
A Trigger Source	V. MODE	Triggered by input signal selected with VERTICAL MODE selector	
	CH1	Triggered by CH1 vertical axis input signal	
	CH2	Triggered by CH2 vertical axis input signal	
	CH3	Triggered by CH3 vertical axis input signal	
	CH4	Triggered by CH4 vertical axis input signal	
	LINE	Triggered by line frequency	
A Trigger Coupling		AC, NOISEREJ, HFREJ, DC, TV FRAME, TV LINE	
A Trigger Level		±90 ° adjustable	
A Trigger Polarity		+/−	
B Trigger Modes		Sterts After Delay, B Triggerable After Delay and TRIG COUNT	
B Trigger Source	CH1	Triggered by CH1 vertical axis input signal	
	CH2	Triggered by CH2 vertical axis input signal	
	CH3	Triggered by CH3 vertical axis input signal	
	CH4	Triggered by CH4 vertical axis input signal	
B Trigger Coupling		AC, NOISEREJ, HFREJ, DC, TV LINE	
B Trigger Level		±90 ° adjustable	
B Trigger Polarity		+/−	
Trigger Sensitivity	COUPLING	FREQUENCY RANGE	MINIMUM SYNC AMPLITUDE
	DC	DC to 50 MHz/DC to 150 MHz	1 div/1.5 div
	AC	20 Hz to 50 MHz/20 Hz to 150 MHz	1 div/1.5 div
	NOISEREJ	Two times of minimum sync amplitude.	
	HFREJ	Increased minimum sync amplitude for above 30 kHz.	
	TV FRAME	1 div (140 IRE)	
	TV LINE	1 div (140 IRE)	

AUTO: Same as above specification for above 50 Hz

FIX: Same as above specification for above 40 Hz.

SPECIFICATIONS

Jitter		0.5 ns or less at 150 MHz at 2 ns/div sweep rate (×10 MAG on)
INTENSITY MODULATION		
Input signal		TTL level (more than 2 Vp-p), positive voltage decreases brightness
Input Impedance		Approx. 10 kΩ
Usable Frequency Range		DC to 10 MHz
⚠ Maximum Input Voltage		50 V (DC+AC peak)
VERTICAL AXIS OUTPUT (CH1 only)		
Output voltage		Approx. 50 mVp-p/div (into 50 Ω load)
Output Impedance		Approx. 50 Ω
Frequency Response		100 Hz to 150 MHz, within −3 dB (at into 50 Ω)
TRACE ROTATION		Electrical, adjustable from front panel
CALIBRATION VOLTAGE		1 V p-p ±1%, Positive square wave, 1 kHz ±3%
READOUT		
Calendar		Year/Month/Day/O'clock/Minute Clock accuracy; ±2 min./month Battery life: About 30,000 hours (at room temperature)
Set Value		CH1−CH4 scale factor (with probe detection), GND, AC/DC, V-UNCAL, ADD, INVERT, BW, A and B sweep scale factor (magnification conversion), SWEEP VERIABLE UNCAL, X-Y (CH2-X), DELAY TIME, TRIG. COUNT
Cursor Mode	ΔV1	Voltage difference between ΔREF and Δcursors on a CH1 scale factor basis
	ΔV2	Voltage difference between ΔREF and Δcursors on a CH2 scale factor basis
	ΔT	Time difference between ΔREF and Δcursors on the basis of sweep scale factor
	1/ΔT	Frequency between ΔREF and Δcursors on the basis of sweep scale factor
		RATIO: Voltage ratio and time ratio between ΔREF and Δcursors, supposing 5-division on the CRT as 100%
		PHASE: Phase difference between ΔREF and Δcursors, supposing 5-division on the CRT as 360°
Cursor Measurement	Resolution	10 bits
	Measurement accuracy	±3%
	Measurement range	Vertical direction: ±3.6 div or more from the CRT center Horizontal direction: ±4.6 div or more from the CRT center
POWER REQUIREMENT		
Line Voltage		100 V/120 V/220 V/240 V AC ±10%
Line Frequency		50/60 Hz
Power Consumption		Maximum 75 W
DIMENSIONS (W×H×D)		310 (332)×150 (163)×400 (448) mm ( ) dimensions include protrusion from basic outline dimensions
WEIGHT		Approx. 9.6 kg
ENVIRONMENTAL		
Within Specifications		10°C to 35°C, 85% max. relative humidity
Full Operation		0°C to 40°C, 85% max. relative humidity
ACCESSORIES SUPPLIED		
Probe		PC-31 (READOUT compatible probe)×2 Attenuation...............1/10 Input impedance........10 MΩ ±1%, 14 pF ±10%
Replacement Fuse		1.2 A×2, 0.8 A×2
Instruction Manual		1

* Circuit and rating are subject to change without notice due to developments in technology.

SAFETY

SAFETY

Before connecting the instrument to a power source, carefully read the following information, then verify that the proper power cord is used and the proper line fuse is installed for power source. The specified voltage is shown at the fuse holder of the AC inlet. If the power cord is not applied for specified voltage, there is always a certain amount of danger from electric shock.

Line voltage

This instrument operates using ac-power input voltages that 100/120/220/240 V at frequencies from 50 Hz to 60 Hz.

Power cord

The ground wire of the 3-wire ac power plug places the chassis and housing of the oscilloscope at earth ground. Do not attempt to defeat the ground wire connection or float the oscilloscope; to do so may pose a great safety hazard. The appropriate power cord is supplied by an option that is specified when the instrument is ordered.
The optional power cords are shown as follows in Fig. 1.

Line fuse

The fuse holder is located on the rear panel and contains the line fuse. Verify that the proper fuse is installed by replacing the line fuse.

Voltage conversion

This oscilloscope may be operated from either a 100 V to 240 V, 50/60 Hz power source. Use the following procedure to change from 100 to 240 volt operation or vice versa.

1. Remove the fuse holder.
2. Replace fuse F 1 with a fuse of appropriate value, 1.2 amp for 100 VAC to 120 VAC operation, 0.8 amp for 220 VAC to 240 VAC operation.
3. Reinsert it for appropriate voltage range.
4. When performing the reinsertion of fuse holder for the voltage conversion, the appropriate power cord should be used. (See Fig. 1.)

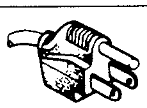
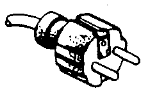
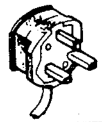
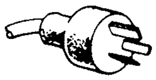
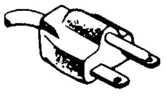
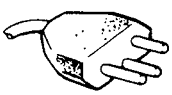
Plug configuration	Power cord and plug type	Factory installed instrument fuse	Line cord plug fuse	Parts No. for power cord and plate
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	1.2 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1820-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	North Europe 0.8 A, 250 V Slow blow 5×20 mm Other Europe 0.8 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1819-05
	U.K. 240 volt/50 Hz Rated 13 amp	0.8 A, 250 V Fast blow 6×30 mm	0.8 A Type C	–
	Australian 240 volt/50 Hz Rated 10 amp	0.8 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1821-05
	North American 240 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.8 A, 250 V Fast blow 6×30 mm	None	–
	Switzerland 240 volt/50 Hz Rated 10 amp	0.8 A, 250 V Fast blow 6×30 mm	None	–

Fig. 1 Power Input Voltage Configuration

CIRCUIT DESCRIPTION

Vertical Attenuator Circuit (X75-1180-00)

The attenuators for channel 1 and channel 2 are operated by the signals from the panel, and AC/DC/GND input coupling and attenuation of 1/1, 1/10, and 1/100 are switched.

The vertical input signal from the BNC input terminal passes through the attenuator and is input to the buffer amp formed by U101 and Q101 (CH2: U201 and Q201). U101 is a source follower and constant current supply and Q101 is for input protection. The input signal is impedance converted by these components and is input to the 1st amp formed by U102 and Q102 (CH2: U202, Q202). A differential signal is created here, and the 1st amp for channel 2 contains an INV circuit which switches the inversion transistor ON/OFF using the data from the R/O unit.

U1 and U2 produce a voltage signal from the serial data from the R/O unit, and this serial data is converted to a 0/5 V parallel signal. Although inversion is not possible on the channel 1 side, the same circuit as the channel 2 circuit is used for circuit stability, and the bias of the inversion transistor is fixed at the off state. The channels 1 and 2 input signals are input to the vertical preamp unit after passing through the 1st amp.

The channels 3 and 4 input signals are input to the 1/1 or 1/5 attenuator as selected by the K301 (CH4 : K401) relay. The signal is then input to the buffer amp formed by Q301 and 302 (CH4: Q401, 402). Q301 is a source follower, Q302 is a constant current supply, and Q303 is for input protection. The signal is impedance converted by this amp. The signal is then input to the 1st amp formed by Q304 and 305 (CH4: Q404, 405). This amplifier produces a differential signal. The channel 3 and channel 4 signals are input to the vertical preamp unit after passing through the 1st amp.

Switch Unit (X69-1150-00)

*** Switch Matrix**

All of the contact switches on the panel form a switch matrix. Pins 1, 2, 3, 4, and 15 of U9 are all low when a contact switch is not pressed, and the output (D0 to D7) is at +5 V.

When a switch is pressed, the output of the switch (one of D0 through D7) goes to low due to Pin 15, 1, 2, 3, or 4 of U9 going to low. The output from D0 through D7 is connected to the R/O unit, and when any of these outputs goes to low, an interrupt is applied to the CPU and serial data is sent to U9. U9 which receives data from the R/O unit, first switches all of Pins 15, 1, 2, 3, and 4 to high and then switches each pin to low. The resulting voltage from the output (D0 to D7) is used to determine which switch was pressed.

*** Panel LED**

The corresponding LEDs on the panel are illuminated when Pins 15 and 1 through 7 of U2 through U8 go from high to low. Serial data from the R/O unit is sent to U2 through U8, and the LED to be illuminated is selected according to that signal.

*** Rotary Encoder**

Rotary encoders are used for the VOLTS/DIV and SWEEP TIME controls for channel 1 and channel 2. The data from these encoders is received by the R/O unit. Refer to the section on the R/O unit regarding operation.

Panel Unit (X66-1050-00)

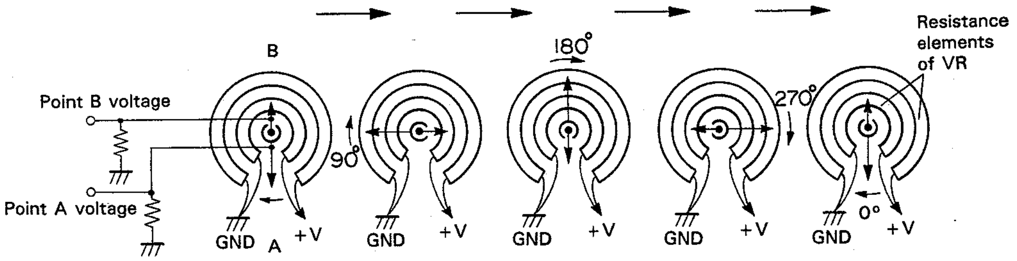
*** VR (VR1 to 10), Uncal Search**

Variable resistors (VR) are used for setting the position, V-variable, trig level, hold off, and T-sep for each channel. Both terminals of each of the VRs are connected to +/− 10 V, +10 V-GND, or +5 V and GND, and the set voltage is sent to the various units.

The collector of Q1, 2 (CH1) or Q3, 4 (CH2) goes from 0 V to approximately +5 V when V-VARIABLE is set to the UNCAL state, voltage is supplied to the R/O unit, and the UNCAL mark (●) appears on the screen.

*** Comparator, Endless VR**

Endless VRs are used in four locations: horizontal variable, horizontal position, Δ, and Δ REF. As shown in Fig. 1, two resistance elements are used alternately for this operation. The output voltage is received by the R/O unit. U1a supplies stable voltage to each terminal of the endless VRs.



CIRCUIT DESCRIPTION

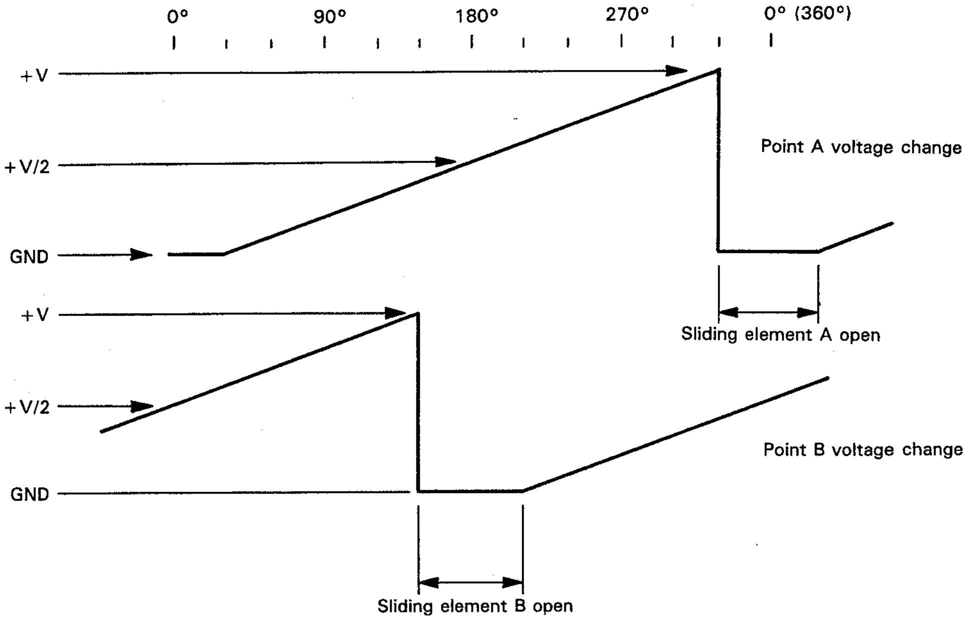


Fig. 1 Endless VR Operation

High Voltage Unit (X68-1510-00)

*** Blanking Circuit**

This is a circuit for amplifying the blanking signal from the horizontal unit. The signal input from P19 passes through the Q8 emitter follower, and is input to Q6 for amplification. Q5 is a constant current supply for Q6 and Q7 is a transistor for absorbing current. Negative feedback is applied to this by R26, and the degree of amplification is determined by R26 and R358 of the horizontal unit. The blanking signal amplified to high voltage is then applied to G1 of the CRT from the high voltage oscillation circuit (described below) using D8 through D10. The G1 potential from K (cathode) is set a low level, and the brightness decreases as this level decreases.

The voltage of the blanking signal of the horizontal unit is altered according to the INT VR of the VR unit, altering the brightness which results.

The output from Q6, ie., the amplified blanking signal, is input to Q4. The brightness is altered by the auto-focus so that the focus point is not lost.

Q3 is a constant current supply for Q4. The signal is then overlapped with the high voltage level using D4 through 7, in the same manner, and the resulting signal is applied to the P1 terminal of the CRT after the potential is controlled by VR23 of the VR unit.

*** High Voltage Oscillation Circuit**

Oscillation at 30 kHz is invoked by Q1, and becomes high voltage by the high voltage block. U1 and Q2 provide negative feedback for control.

Power Supply Unit (X68-1500-00)

The power supply circuits is comprised of six regulated output systems (+5, +/−10, +15, +60, and +140 V) and two unregulated systems (+/−13 V).

The regulated outputs are all with reference to −10 V. This −10 V output uses a 5 V Zener diode (D5) as reference, and is obtained by the drive transistor (Q6) and op amp U3. Other regulated output is obtained using op amps (U1, 2, and 3) and transistors (Q1, 3, 5, 6, 7, and 8), with this −10 V output as reference.

The unregulated output of +/−13 V uses the voltage before regulation to obtain regulated output of +/−10 V.

VR Unit (X81-2330-00)

*** Calibration Voltage Generation Circuit**

Op amp U1 is used as an oscillator, and the DC voltage is switched using D1 to generate a 1kHz square wave.

*** Scale Illumination Circuit**

This circuit drives an illumination lamp with the Q6 emitter follower as an output stage. D4 and 5 are used for switching to provide one-shot illumination.

*** Trace Rotation Circuit**

This circuit drives a coil for rotation by the Q2 and 3 emitter followers.

*** Intensity Circuit**

This circuit has three 20KB VRs, A SWEEP, B SWEEP, and R/O, both ends are connected to +/−10 V, and the set voltage is sent to the horizontal unit to create a blanking signal. The R/O VR is equipped with an ON/OFF switch.

CIRCUIT DESCRIPTION

Final Unit (X80-1100-00)

*** Vertical Amplification System — Vertical Final Preamp to Vertical R/O Switching to Vertical Final Amp**

The signal output from the vertical preamp unit and which passed through the delay line, is input to the vertical amplification system of the final unit. The signal first passes through the Q1 and Q2 emitter followers, and is input to Q3 and Q4 for amplification. Q203 and 204 alternately select Q3 and Q4 which amplify the waveform for output of characters on the CRT screen by the R/O function and Q201 and Q202 which amplify the character information sent from the R/O unit. When the ROREQ signal from the R/O unit is high, Q204 is switched ON, Q3 and 4 are switched ON, Q203 is switched OFF, and Q201 and 202 are switched OFF. The signal is amplified and the character information is not input. When the ROREQ signal is low, the opposite occurs, and the character information is amplified without signal input. The signal then enters the Q5 and 6 base grounded amp, is impedance converted by the Q7 and 8 emitter follower, is input to the final amp formed by Q9, 10, 13, 11, 12, and 14, and is input to the deflection plate of the CRT.

*** Horizontal Amplification System — Horizontal Final Preamp to Horizontal R/O Switching to Horizontal Final Amp**

The signal sent from the horizontal unit is input to the Q101, 102 base grounded amp, and is amplified by Q103, 104 after passing through D101, 102, 105 and 106 for excessive input limiting. In the same manner as the vertical system, Q208, 209 switches between the amp for signal formed by Q103, 104 and the amp for characters formed by Q206, 207.

Following this, the signal is input to the Q105, 106 base grounded amp, is impedance converted by the Q107, 108 emitter follower, is amplified by Q109, 110, is impedance converted by the Q112, 113 emitter follower, and is input to the Q114, 115 amp. Q116, 117 form a constant current supply to supply a fixed current level to Q114, 115. Negative feedback is applied to the output by R114, 145, 153, and 154, and the degree of amplification is determined by R144, 145, 153, 154 and R152, 133. This configuration provides stability and allows for amplification with high amplitude.

Vertical Preamp Unit (X73-1760-00)

The channel 1 and channel 2 signals output from the ATT unit enter the vertical preamp unit and are first input to the buffer amp formed by Q101 (CH2: Q201). The signals are then input to the X5 and X1 amps. The X5 amp is formed by Q102 (CH2: Q202) and the X1 amp by Q103 and 104 (CH2: Q203, 204). Switching between the amps is by Q105 and 106. When Q105 is ON, Q106 is OFF and the X5 amp is selected. When Q106 is ON, Q105 is OFF and the X1 amp is selected. The signal which passed through Q108, 109 (CH2: Q208, 209) cascode connected to Q102, 103, 104 (CH2: Q202, 203, 204) is input to the 1/1, 1/2, or 1/4 ATT, switched by the K101 (CH2: K201) relay. The signal emerging from the ATT is impedance converted by Q112, 113 (CH2: Q21, 213), and input to Q114, 115 (CH2: Q214, 215). There is a vertical variable circuit formed by R169, 170, D103, 104, 150, 151, 152, 153, 154, and 155 (CH2: R269, 270, D203, 204, 250, 251, 252, 253, 254, and 255) between the cascode connections. This circuit applies the DC signal for variable control sent from the panel by V101 (CH2: V201) to the cathode of the diode to divert the current, altering the diode impedance to vary the gain.

The CH1 and CH2 signals emerging from the cascode amp which forms the 3rd amp are impedance converted by the buffer amp formed by Q119, 120 (CH2: 219, 220), and input to the amp for trig signal output (formed by Q601 to 604), Q528 and 529 cascode connected to Q501 and 502. Between the cascode amps, there is an amp for POSI variation by Q503, Q504 (CH2: Q507, 508) and a CH selection circuit formed by Q1 and 2 (CH2: Q3, 4). Although the trigger signal output amp is a balanced circuit using Q601 and 602 (CH2: 605, 606), only Q601 (CH2: Q605) actually extracts the trigger signal, and this component is cascode connected to Q603 (CH2: Q607). Subsequent explanation on this trigger amp will be given below.

*** CH3 and 4 3rd Amp to Select SW**

Q301 and 302 (CH4: Q401, 402) are cascode connected to Q304 and 305 (CH4: 404, 405) of the attenuator unit, and there are resistors and capacitors for gain control and frequency response correction between them. The signal emerging from the cascode amp enters the buffer amp formed by Q304, 305 (CH4: Q404, 405), is impedance converted, and input to the 1st trig amp.

The input to the trig amp is approximately 50% of the output from the 3rd amp, and a balance circuit is formed by Q609 and 610 (CH4: Q613, 614) for balancing. However, the signal extracted as the trigger signal is actually only the signal from the Q609 side (CH4: Q613). Subsequent explanation on this trigger amp will be given below.

The signal output from the 3rd amp will be input to the trig amp and V. mode select switch. This is formed by Q509, 510 (CH4: Q513, 514) and Q5, 6 (CH4: Q7, 8). When the V. mode is selected, Q5, 6 (CH4: : Q7, 8) are OFF, and the signal passes through D505, 506 (CH4: D507, 508), and is input to the mix amp. When this mode is not selected, Q5, 6 (CH4: Q7, 8) are ON, and the signal is cancelled. This operation is the same for channels 1 and 2. Q511, 512 (CH4: Q515, 516) between Q509, 510 (CH4: Q513, 514) and Q5, 6 (CH4: Q7, 8) form a POSI variable amp which changes the bias of Q512 (CH4: Q516) to vary the position, according to the DC voltage from the panel.

*** Mix Amp to 4-ch Amp to T. SEP Amp to 20 MHz BW SW**

The signals which passed through the select switches for the various channels and diodes D501 through 508, are input to the mix amp formed by Q528, 529. Q518 is ON when ADD is selected in the V. mode. The impedance of the signal is then converted by the buffer amp formed by Q519, 520, and input to the T. SEP amp formed by Q522 and 523. In this T. SEP amp, the B SWEEP position is altered by input of a control signal to the base of Q523 for switching so that the amp only operates by the B sweep signal.

The impedance of the signal which passed through the T. SEP amp is converted by the buffer amp formed by Q524, 525, and the signal is input to the delay line. A switch for performing 20 MHz BW is formed by Q526, 527, a low-pass filter is formed by C509, 510, and the circuit functions as a 20 MHz BW. The signal then passes through a delay line and is input to the final unit.

*** 1st Trig Amp — Trig Select — 2nd Trig Amp**

The trigger signal extracted by Q601 and 602 (CH1), Q605 and 606 (CH2), Q609 and 610 (CH3), and Q613 and 614 (CH4) is input to the amps formed by Q603 and 604 (CH1), Q607 and 608 (CH2), Q611 and 612 (CH3), and Q615 and 616 (CH4). It is then input to trig select after impedance conversion. At this time, a portion of the channel 1 signal is split to the CH1 out amp formed by Q621 and 622, and a portion of the channel 2 passes through Q620 and becomes the X signal for the X-Y mode.

Trig select is a switch formed by D601, 602, 603, and Q623 to 621. When the various transistors are switched on by the CH select logic signal, the diode connected to the transistor has reverse polarity and goes off. The diode can be switched on by switching the transistor off, and the trigger signal will be output to the amp in the next stage. D601 receives the A trig, D602 receives the B trig, and D603 receives the line trig.

The trigger signal received by trig select is impedance converted by the 2nd trig amp formed by Q617 and 632 (A trig) and Q618 and 633 (B trig), and is then sent to the horizontal unit.

*** Control of vertical preamp unit**

The following signal are sent from the R/O unit for control of the vertical preamp unit.

(1) Serial data .... this signal is sent from the R/O unit together with the clock signal, and input to U1, U2, U3, U4, U5, U6, U7, and U8 for conversion to parallel data.
The following are controlled by this signal:
X1 and X5 amp switching
1/1, 1/2, 1/4 ATT switching
V-MODE switching
20 MHz BW limit
Trigger signal selection

(2) Voltage supplied directly from panel .... voltage between 0 V and 10 V is created by the variable resistors on the panel, and is input as a signal to the vertical preamp unit through the R/O unit.
POSI variation
V-VAR

The above are the signals externally input for control.

Horizontal Unit (X74-1480-00)

The trigger signals (ATR, BTR signal) supplied from the vertical preamp unit (X73-760-00) are input to the trig preamps. The A trig preamp is formed from Q1 and Q2, etc., and the B trig preamp is formed from Q14 and Q15, etc. When a TV signal is input, TV coupling is selected to amplify the TV sync signal. The control signal to perform this is output from U29, and the gain of Q1 and Q14 is changed by switching with Q9 to correspond to the TV sync signal. The trigger level is altered after the signal passes through the trig preamp. The trigger level of A-sweep is altered by U21 and the level of B-sweep by U22. The level is switched by the U16 analog switch by panel switch operation, and the FIX signal, TV signal, and A BLVL signal are selected. The input signal with trigger level altered is input to the trig amp formed by Q5, Q6, Q7 and Q17, Q18, and Q19. When coupling is set to HFREJ by operation of the panel switch, a control signal is output from U29, Q8 or Q20 is switched on, and the high frequency components are attenuated. The signal is input to the Schmitt circuit formed by U1 or U2 after passing through the trig amp. The hysteresis width of the Schmitt circuit is altered by the noise rejection control signal output from U29, allowing stable triggering even for input signals containing noise. The control signal output from U30 determines whether the slope is positive or negative.

The signal output from the A-sweep Schmitt circuit is input to the auto freerun circuit formed by Q103 and Q104 to control U39 according to the auto or normal mode. This sets the unit to the sweep mode or trigger standby mode.

The signal output from the B-sweep Schmitt circuit is input to U3b and Q127. The signal input to Q127 is converted to the TTL level and input to U8, U9, and U10.

U8, U9, and U10 form a trigger counter circuit which is comprised from a counter IC. The signal output from the Schmitt circuit is input as the clock signal to this counter, the counter is incremented until it reaches the trigger counter data set by U30 and U31, and a B-sweep is then triggered.

The AS signal output from Q of U3a is input to Q109 of the A-sweep circuit, performing start and stop control of the A-sweep. U24b in the A-sweep circuit takes the analog voltage supplied from the R/O unit and amplifies it to 5 V at range 1, 2.5 V at range 2, and 1 V at range 5. The current is determined by this voltage and the aggregate resistance selected by the U17 analog switch. This determines the sweep time.

The AS signal output from Q of U3a and the BS signal output from Q of U3b are input to the blanking circuit formed by U4, the UNBL signal is generated from ROUBL, ROINT, BINT, AINT, etc., and supplied to the high voltage unit (X68-1510-00).

In the same manner as the A-sweep circuit, U26D in the B-sweep circuit amplifies the analog voltage fed from the R/O unit, and determines the current by the U18 analog switch to determine the sweep time.

The A-sweep signal output from Q116 and the B-sweep signal output from Q134 are input to the mix amp formed by U19, Q302, Q303, Q304, Q306, and Q307. In this circuit, the analog voltage supplied from X10 MAG and the R/O unit are amplified by U27, and H-POSI control is performed. The signals output from this circuit are fed to the final unit (X80-1060-00) as the X+ and X- signals.

Switching between A-sweep and B-sweep is controlled by U7, and this signal is sent to the mix amp and blanking circuit. The switching signal for chopping of A-sweep and B-sweep is generated by the circuit formed by Q403 and Q404. The chop frequency at this time is 500 kHz.

Delayed sweep is performed by comparing the voltage of the A-sweep output from Q116 and the DTP signal supplied from the R/O unit by the delay comparator formed by Q102, U25, etc, and the position to start the B-sweep is determined. The signal to start the B-sweep at this time is input to the logic circuit for B-sweep formed by U13a, b, c, and U6, and the signal to output the BS signal is sent to U3b.

In the single sweep mode, the SGL signal supplied from the R/O unit is input to the A-sweep logic circuit formed by

CIRCUIT DESCRIPTION

U11b, U12d, and U5, and the A-sweep trigger standby mode is selected when the RESET signal is input.
There is also a 1-shot ILLM circuit which illuminates a lamp for approximately 1 second when the single sweep is completed. This circuit is formed from U12, Q405, Q406, C405, and C406, etc.

Readout unit (X77-1490-00)

The R/O unit contains an 8-bit Z-80A CPU, and has two major functions: control of the operation of the various sections and the output of CRT character information.
The basic clock which forms the basis for the timing of all IC operations is generated by the 10 MHz oscillator formed by U11d and X1. The 10 MHz CLK is used for operation of U33 (R/O controller), and this clock signal is divided to 1/4 by U10 to create the 2.5 MHz CLK. This clock signal is used for operation of the U5 CPU (Z-80A) and as a control signal for sending data and addresses to U33.
Changes in information from the switch unit (X69-1150-00) and the timing, clock, and soft timers for the CRT display are all realized through interrupts which are sent to the CPU.
Changes at the switch unit include interrupts issued when a pushbutton switch is pressed and when the rotary encoders used for VOLTS/DIV and SWEEP/DIV are rotated.
When a switched is pressed, one of lines D0 through D7 of U24 connected as a data bus for switch information goes to "L". U14e goes to "L" causing Q of U21a to also go to "L", notifying the CPU that a switch position has been changed.
When CRT information is changed by operation of the switches or variable resistors on the panel, the timing for updating the CRT indication is output every 13.5 μs from U33. The change is latched to U21a, and indicated to the CPU as an interrupt. The CPU recognizes this interrupt and performs processing to update the CRT indication.
U12, U13, U17, and U18 form the inport section which outputs the data decoded by U6 and U8 to the data bus. U12 is an inport IC for evaluating the probe detection (1/1 to 1/10), battery capacity, and status of the CH1 and CH2 variables. Probe detection and variable status are fetched by the CPU approximately every 15 μs, and evaluated and processing performed. The B1 battery capacity is monitored by U46a, and when the level drops below approximately 2.4 V, the status (H level) is fetched from the inport at POWER ON, and "BATT DOWN" is displayed on the CRT screen.
U13 is an inport IC for interrupt evaluation, and it determines whether an interrupt such as rotary encoder (CH1, CH2, SWEEP), 2 msec, clock, switch, or CRT indication has been transmitted to the CPU.
U17 receives the A-phase and B-phase status of the rotary encoder, receives and evaluates the movement of the endless VR, and receives and evaluates the single ready state. Reception and evaluation of the endless VR movement is made by having U35 compare the endless VR voltage and D/A convertor (U37) voltage, to determine whether the endless VR has been rotated. U18 is an IC for fetching data from the panel switches, and it receives the state when a switch is pressed.
U6 through U9 are a decoder circuit, and U6 uses PAL. The PAL has a circuit configuration capable of decoding the inport and output clocks, ROM, and RAM. U7 through U9 decode individual information selected by U9.
U8 outputs the decoded information from inport U12, 13, 17, and 18, and the latch CLK (VLC, HLC, ALC, and LLC) for serial transfer.
U19 outputs the latch CLK (SLC) for serial transfer and the shift CLK (ASC, LSC, SSC, HSC, VSC).
U7 outputs the data latch CLK for serial transfers, the interrupt latches (U20, U21, U22, and U23), and the RESET pulse. The data latch CLK is also used as the CLK for latching the data for serial transfers by U16.
A blanking signal is applied during serial transfer to prevent the effects of noise on the waveform. This blanking is output from Pin 21 of U33.
U1 is RAM, and 2 K×8 bit memory is used. This SRAM is backed up by B1 when the power is off, and the power is switched by U19 when the power is turned on/off. Switching is performed by the U4 power reset IC, and a reset signal is supplied to U3, U5, and U19 at 4.4V +/−0.2 V.
U2 is a software ROM, and both 16 K and 32 K can be used by switching by R128 and R256.
Although CTM5020 (U33) can be directly connected to 8080-type CPUs, direct connection of address and data is not possible with the Z-80 due to the absence of an ALE terminal. For this reason an ALE signal is generated by the ADD/DATA SELE circuit formed by U27, U28, U23b, U14b and d, U25b, and U29c to allow connection with U33.
The software timer needed for CPU operation is created by U26 as a 2 ms timer. This is latched to U20a every 2 ms to indicate an interrupt to the CPU.
U3 is backed up by lithium battery B1 when the power is off, and the 32.768 kHz basic clock from the crystal oscillator operates. An interrupt signal is output from U3 once every minute, and is latched to U20b. The calender indication on the CRT is advanced one minute by the input of this interrupt.
The U37 D/A convertor creates the voltage output for endless VR comparison, the analog control voltage used by the horizontal unit (X74-1480-00), and the cursor control voltage. The latter control voltage is switched by the U41 analog switch, and is output once every 4 ms by time division. This output control is performed by AX0 through AX3 of U33, and AX3 is a control terminal to prevent the comparison voltage being output to the control voltage when this voltage for endless VR comparison is output from the U37 D/A convertor.
The cursor control voltage (Δ and Δ REF) output from U41 is switched with R/O-Y and R/O-X by the U40 and 43 analog switches, and output to the final amp.
There are analog control voltages used by the horizontal unit: A-vari, B-vari, DTP, and H-posi.
A-vari and B-vari output the reference voltages for sweep A and sweep B, and the voltage determined by the 1-2-5 range is output (during CAL). During UNCAL, the A-vari and B-vari voltage changes and the sweep time changes. At this time, the voltage is changed so that the amount of variation changes at the various ranges so that variation rate corresponds to the rotational speed of the endless VR. The count distribution is 2000 for range 1, 1000 for range 2, and 400 for range 5, and the amount of change per step is altered every 10, 6, and 2 counts respectively. A-vari passes through the U47b buffer amp with the voltage level

maintained by the hold circuit and B-vari passes through the U47a buffer amp before both are fed to the horizontal unit (X74-1480-00).

The following is a description of the operation of the rotary encoder used for switching volts/div and sweep time.

The rotary encoder has two outputs, and rotation to the right or left is determined by the output resulting from the phase difference.

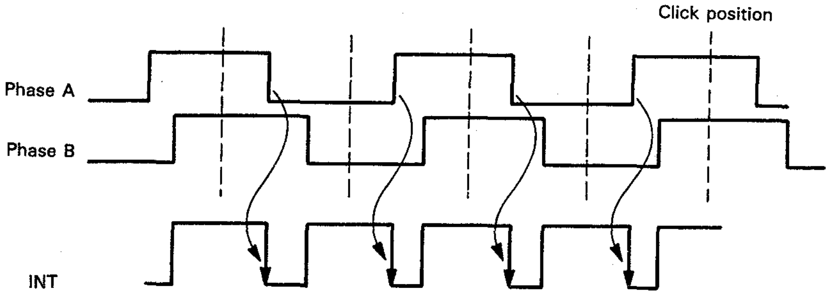


Fig. 2

Figure 2 shows the output waveforms of the rotary encoder, and phases A and B have the output waveforms indicated. In the case of the CH1 VOLTS/DIV rotary encoder, for example, the outputs from phases A and B are input to U29b and U31c respectively. U29 and U31 form a Schmitt circuit, eliminating chattering occurring when the rotary encoder is rotated, and shaping the waveforms to resemble those shown in the above diagram. (This is performed to prevent spurious operation.)

The signal with the waveform shaped is input to U30c, output as the INT signal shown in Figure 2. Q of U22a goes to "L" at the point indicated by the arrow and an interrupt signal is sent to the CPU. When the CPU enters the interrupt state, it immediately evaluates the status of phases A and B, determines the rotation to the right or left by the status of the change, and performs the appropriate processing. (The figure shows rotation to the right.)

U31a and U31b form the Schmitt for the CH2 VOLTS/div rotary encoder, U30d receives the signal after waveform shaping, and U23a receives the INT signal. U31d and U30a form the Schmitt for the CH2 Sweep Time/div rotary encoder, U30b receives the signal after waveform shaping, U22b receives the INT signal.

The DTP adds two analog voltages and is a 5000 count FS. These analog voltages are V-Delay and C-Delay. V- Delay is counted up to 4000 counts with C-Delay as 0 V, and is added by U45b. Following this, V-Delay and C-Delay are decreased one count each until 5000 counts are reached. This is equivalent to doubling the D/A resolution. The added DTP voltage passes through the U46b buffer amp, and is fed to the horizontal unit (X74-1480-00).

The voltage from the endless VRs used for cursor, H-POSI, and H-VARI is received by the U34 analog switch, and the control signal for selecting the endless VR is selected by VX0 to VX2 of U33. The output of the endless VR selected by U34 is input to U35, and compared with the voltage output from D/A convertor U37 by U35. As the U37 D/A convertor is a 12-bit unit and 8 bits are output to the D/A (U33 DA0 to DA7), the upper 4 bits are latched by U36 and the remaining 8 bits are then output. The discrete circuit formed by Q1, Q2, etc., and connected to Pin 17 of U37 is a DC-DC convertor circuit used to supply −11 V to the D/A convertor.

The H-POSI voltage is supplied to the horizontal unit through the hold circuit.

A random can method (X-Y display) is used for character display, and the U32 character generator is controlled by the character counter of the U33 R/O controller and the dot counter.

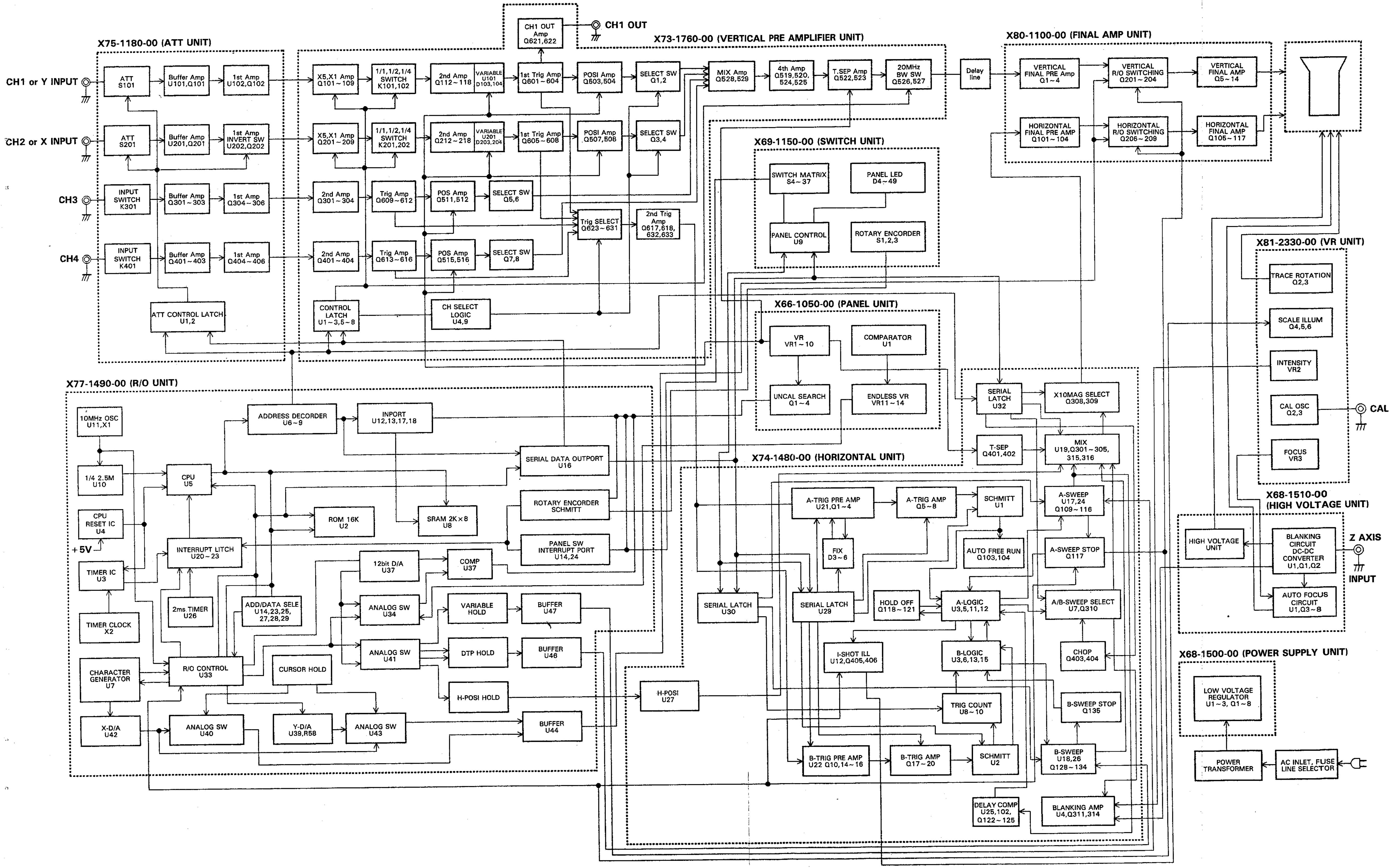
One cycle for readout indication is divided into four, and consists of lower characters, upper characters, Δ REF cursor, and Δ cursor.

Character data having a basic configuration of 5×7 dots is input to the U32 character generator. The 3 bits from D00 to D02 are X-axis data, the four bits D03 to D06 are the Y-axis data, and D07 is the character start/end control signal. The digital signal output from U32 is converted to the analog voltages by the U42 D/A convertor for the X-axis signal and the D/A convertor for the Y-axis signal formed by U39 and R58. These signals pass through analog switches U40 and U43, the U44 buffer amp, and are supplied to the final unit (X80-1100-00) as the R/O-X and R/O-Y character signals.

Character dot display on the CRT is controlled by the ROUB, ROB, and ROQ signals output from Pins 86, 87, and 88 of U33.

The ROB signal erases the real waveform display, the real waveform and readout are switched by the ROQ signal, and dot indication on the readout is performed by the ROUB signal.

BLOCK DIAGRAM


CH1 OUT Amp Q621,622
CH1 OUT
X75-1180-00 (ATT UNIT)
X73-1760-00 (VERTICAL PRE AMPLIFIER UNIT)
X80-1100-00 (FINAL AMP UNIT)
CH1 or Y INPUT
CH2 or X INPUT
CH3
CH4
ATT S101
Buffer Amp U101,Q101
1st Amp U102,Q102
ATT S201
Buffer Amp U201,Q201
1st Amp INVERT SW U202,Q202
INPUT SWITCH K301
Buffer Amp Q301~303
1st Amp Q304~306
INPUT SWITCH K401
Buffer Amp Q401~403
1st Amp Q404~406
ATT CONTROL LATCH U1,2
X5,X1 Amp Q101~109
1/1,1/2,1/4 SWITCH K101,102
2nd Amp Q112~118
VARIABLE U101 D103,104
1st Trig Amp Q601~604
POSI Amp Q503,504
SELECT SW Q1,2
X5,X1 Amp Q201~209
1/1,1/2,1/4 SWITCH K201,202
2nd Amp Q212~218
VARIABLE U201 D203,204
1st Trig Amp Q605~608
POSI Amp Q507,508
SELECT SW Q3,4
2nd Amp Q301~304
Trig Amp Q609~612
POS Amp Q511,512
SELECT SW Q5,6
2nd Amp Q401~404
Trig Amp Q613~616
POS Amp Q515,516
SELECT SW Q7,8
Trig SELECT Q623~631
2nd Trig Amp Q617,618, 632,633
CONTROL LATCH U1~3,5~8
CH SELECT LOGIC U4,9
MIX Amp Q528,529
4th Amp Q519,520, 524,525
T.SEP Amp Q522,523
20MHz BW SW Q526,527
Delay line
VERTICAL FINAL PRE Amp Q1~4
VERTICAL R/O SWITCHING Q201~204
VERTICAL FINAL AMP Q5~14
HORIZONTAL FINAL PRE AMP Q101~104
HORIZONTAL R/O SWITCHING Q205~209
HORIZONTAL FINAL AMP Q105~117
X69-1150-00 (SWITCH UNIT)
SWITCH MATRIX S4~37
PANEL LED D4~49
PANEL CONTROL U9
ROTARY ENCORDER S1,2,3
X66-1050-00 (PANEL UNIT)
VR VR1~10
COMPARATOR U1
UNCAL SEARCH Q1~4
ENDLESS VR VR11~14
X81-2330-00 (VR UNIT)
TRACE ROTATION Q2,3
SCALE ILLUM Q4,5,6
INTENSITY VR2
CAL OSC Q2,3
CAL
FOCUS VR3
SERIAL LATCH U32
X10MAG SELECT Q308,309
T-SEP Q401,402
MIX U19,Q301~305, 315,316
X77-1490-00 (R/O UNIT)
10MHz OSC U11,X1
ADDRESS DECORDER U6~9
INPORT U12,13,17,18
1/4 2.5M U10
CPU U5
SERIAL DATA OUTPORT U16
CPU RESET IC U4
+5V
ROM 16K U2
SRAM 2K×8 U8
ROTARY ENCORDER SCHMITT
INTERRUPT LITCH U20~23
PANEL SW INTERRUPT PORT U14,24
TIMER IC U3
12bit D/A U37
COMP U37
2ms TIMER U26
ADD/DATA SELE U14,23,25, 27,28,29
ANALOG SW U34
VARIABLE HOLD
BUFFER U47
TIMER CLOCK X2
ANALOG SW U41
DTP HOLD
BUFFER U46
CHARACTER GENERATOR U7
R/O CONTROL U33
CURSOR HOLD
H-POSI HOLD
H-POSI U27
X-D/A U42
ANALOG SW U40
Y-D/A U39,R58
ANALOG SW U43
BUFFER U44
X74-1480-00 (HORIZONTAL UNIT)
A-TRIG PRE AMP U21,Q1~4
A-TRIG AMP Q5~8
SCHMITT U1
A-SWEEP U17,24 Q109~116
FIX D3~6
AUTO FREE RUN Q103,104
A-SWEEP STOP Q117
SERIAL LATCH U30
SERIAL LATCH U29
HOLD OFF Q118~121
A-LOGIC U3,5,11,12
A/B-SWEEP SELECT U7,Q310
I-SHOT ILL U12,Q405,406
B-LOGIC U3,6,13,15
CHOP Q403,404
TRIG COUNT U8~10
B-SWEEP STOP Q135
B-TRIG PRE AMP U22 Q10,14~16
B-TRIG AMP Q17~20
SCHMITT U2
B-SWEEP U18,26 Q128~134
DELAY COMP U25,102, Q122~125
BLANKING AMP U4,Q311,314
X68-1510-00 (HIGH VOLTAGE UNIT)
HIGH VOLTAGE UNIT
BLANKING CIRCUIT DC-DC CONVERTER U1,Q1,Q2
Z AXIS INPUT
AUTO FOCUS CIRCUIT U1,Q3~8
X68-1500-00 (POWER SUPPLY UNIT)
LOW VOLTAGE REGULATOR U1~3, Q1~8
POWER TRANSFORMER
AC INLET, FUSE LINE SELECTOR

ADJUSTMENT

To obtain the best performance, periodically calibrate the unit. Sometimes, only one mode need be calibrated, while at other times, all modes should be calibrated. When one mode is calibrated, it must be noted that the other modes may be affected. When calibrating all modes, perform the calibration in the specified sequence.

The following calibration required an accurate measuring instrument and an insulated adjusting flat blade screwdriver. If they are not available, contact your dealer. For optimum adjustment, turn the power on and warm up the scope sufficiently (more than 30 minutes) before starting.

Before calibrating the scope, check the power supply voltage.

TEST EQUIPMENT REQUIRED

The following instrument or their equivalent should be used for making adjustment.

Test Equipment	Model	Minimum Specification
Digital Multi-Meter	DL-706 (KENWOOD)	Impedance: More than 10 MΩ, Measuring range: 0.01 V to 199 V
Sine-Wave Generator	651 B (YHP)	Frequency: 10 Hz to 10 MHz, constant voltage over tuning range
Sine-Wave Generator	SG-503 (Tektronix)	Frequency: 50 kHz to 100 MHz, Output impedance: 50 Ω, constant voltage over tuning range
Square-Wave Generator	PG-506 (Tektronix)	Output signal: 1 kHz, Amplitude: 10 mVp-p to 10 Vp-p, Accuracy: within ±1%, Rise time: 35ns or less 100 kHz, Rise time: 1 ns or less
Q Meter	4343B (YHP)	–
Color Pattern Generator	CG-911A (KENWOOD)	–
Oscilloscope	475A (Tektronix)	Sensitivity: more than 5 mV Frequency response: More than 250 MHz
Time-Marker Generator	TG-501 (Tektronix)	Time mark: 0.5 s to 0.1μs repetive waveform
High-Voltage Probe	–	Input Impedance: 1000 MΩ
Termination	–	Impedance: 50 Ω Accuracy: within 3%
Termination	–	3 watts type impedance: 50 Ω
Attenuator	–	–20 dB attenuation (50 Ω)

Table 1

PREPARATION FOR ADJUSTMENT

Control Settings

The control settings listed below must be used for each adjustment procedure.

Exceptions to these settings will be noted as they occur. After completing a adjustment, return the controls to the following settings.

NAME OF KNOBS	POSITION
INTEN	12 o'clock, A INTEN
READOUT INTEN	Fully counterwise
FOCUS, ASTIG	Optimum position
CH1, CH2, CH3, CH4 ⬍ POSITION	Mechanical center
◄► POSITION/×10MAG	Mechanical center/push
VARIABLE, H.VARIABLE (VOLTS/DIV, SWEEP TIME/DIV)	CAL
AC-GND-DC (CH1 and CH2)	DC (GND at no signal)
VERTICAL MODE	CH1
TRIGGERING COUPLING	AC
TRIGGERING SOURCE	CH1
TRIGGERING LEVEL	Mechanical center
TRIGGERING MODE	AUTO
VOLTS/DIV (CH1 and CH2)	10 mV/DIV
SWEEP TIME/DIV	1 ms/DIV
HORIZONTAL MODE	A
HOLDOFF	NORM

Table 2

ADJUSTMENT

1. POWER SUPPLY AND CRT SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
–10 V	VR1	X68-1500	Adjust VR1 so that the voltage at pin 8 of the connector P17 is –10.00 V.
Intensity	VR1	X68-1510	Display the spot on the CRT screen, and adjust VR1 so that the spot disappears when the INTEN knob is set to the 9 o'clock position.
Focus Center	VR2	X68-1510	Push the FOCUS knob in (for the FOCUS operation) and then set it to the mechanical center position. Pull the knob out (for the ASTIG operation), display a spot on the screen, and adjust the ASTIG control and VR2 to minimize the dimension of the spot.
CRT Center	VR513	X73-1760	VERTICAL MODE: CH1, CH2, ADD Make the luminescent line overlap at each ⬍ position. Adjust VR513 so that the luminescent line is moved to the center of the CRT screen.
Vertical Center Voltage	VR3	X80-1100	Turn off R/O. In the state of CRT Center Adjustment, adjust VR3 so that the voltage at pin 1 of the connector P14 becomes 37.5 V.
Horizontal Center Voltage	VR102	X80-1100	Engage the CH1 mode. Activate the X-Y operation mode, and set so that the spot moves to the center of the CRT. Adjust VR102 so that the voltage at pin 1 of the connector P15 becomes 67.5 V.
R/O Vertical Gain	VR4	X80-1100	Set the ΔV VR control to "MIN" and "MAX" (↺ ↻) in turns. Adjust VR102 so that the separation between these two settings for the cursor is of 8 divisions of the scale.
R/O Vertical Position	VR201	X80-1100	In the state of the R/O Vertical Gain Adjustment, adjust VR201 to meet the following scale values: 0 division –↺ 8 divisions –↻
R/O Horizontal Gain	VR101	X80-1100	Set the ΔT VR control to "MIN" and "MAX" (↺ ↻) in turns. Adjust VR101 so that the separation between these two settings for the cursor is of 10 divisions of the scale.
R/O Horizontal Position	VR202	X80-1100	In the state of R/O Horizontal Gain Adjustment, adjust VR202 to meet the following scale values: 0 division –↺ 10 divisions –↻

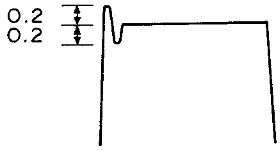
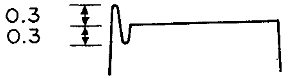
2. VERTICAL SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH2 Balance	VR201	X75-1180	Adjust VR201 so that even when the CH2 INV switch is turned ON/OFF repeatedly, the luminescent lines does not move.
CH2 Position	VR101	X75-1180	Short between pin 1 and pin 3 at P5. Set the vertical mode to "CH1", "CH2", then "ADD". Set it to the scale center by "⬍ POSITION". Remove the short-circuiting. Adjust VR101 so that the deviated luminescent line comes to the scale center.
CH1 Step ATT Balance	VR103 VR101	X73-1760	Adjust VR103 so that the position of the luminescent line does not change even when the vertical attenuator is selected between 1 and 2 mV range. Switch the range between 2 and 5 mV ranges, and perform the same adjustment using VR101.

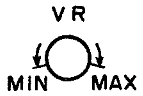
ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH2 Step ATT Balance	VR203 VR201	X73-1760	Adjust in the same way as for CH1.
CH1 Position Center	VR503	X73-1760	CH1 POSITION : Mechanical center position CH1 VOLTS/DIV : 0.1 mV Adjust VR503 so that the trace is located on the center of the screen.
CH2 Position Center	VR506	X73-1760	Adjust in the same way as for CH1.
CH3 Position Center	VR509	X73-1760	Adjust in the same way as for CH1.
CH4 Position Center	VR512	X73-1760	Adjust in the same way as for CH1
CH1 Variable Balance	VR104	X73-1760	Adjust VR104 so that the position of the luminescent line does not change even if the VARIABLE knob is rotated. Vary the settings of the VOLTS/DIV and VARIABLE controls and see if the trace position also moves; if it does, adjust VR103, 101 and 104 again.
CH2 Variable Balance	VR204	X73-1760	Adjust in the same way as for CH1.
CH1 Gain	VR501	X73-1760	CH1 VOLTS/DIV: 10 mV Input a square wave signal having an amplitude of 50 mV, and adjust VR501 so that the CRT amplitude becomes 5 div.
CH1 1 mV Range Gain	VR102	X73-1760	CH1 VOLTS/DIV: 1 mV Input a square wave signal having an amplitude of 5 mV, and adjust VR102 so that the CRT amplitude becomes 5 div.
CH2 Gain	VR504	X73-1760	Adjust in the same way as for CH1.
CH2 1 mV Range Gain	VR202	X73-1760	Adjust in the same way as for CH1.
CH3 Gain	VR507	X73-1760	CH3 VOLTS/DIV: 0.1 mV Input a square wave signal having an amplitude of 50 mV, and adjust VR507 so that the CRT amplitude becomes 5 div.
CH4 Gain	VR501	X73-1760	Adjust in the same way as for CH1.
CH1 Waveform Shaping	TC105 TC103	X75-1180	AC-GND-DC: DC Apply 1 kHz square wave to CH1 input (with the amplitude extending over 4 to 6 div). Set CH1 VOLTS/DIV to 0.1 V range (and 1 V range), and adjust TC105 (and TC103) so that the waveform becomes flat in both ranges.
CH1 Input Capacity	TC104 TC102	X75-1180	AC-GND-DC : DC CH1 VOLTS/DIV : 10 mV Connect the capacity meter to the CH1 input, and measure the input capacity in the 10 mV range. Adjust TC104 and TC102, alternately, so that the input capacity in the 0.1 V and the 1 V ranges equals the same capacity as in the 10 mV range.
CH2 Waveform Shaping	TC205 TC203	X75-1180	Adjust in the same way as for CH1.
CH2 Input Capacity	TC204 TC202	X75-1180	Adjust in the same way as for CH1.
CH3 Waveform Shaping	TC302	X75-1180	Apply 1 kHz square wave to CH1 input (with the amplitude extending over 4 to 6 div). Set CH3 volts/div to 0.5 V range, and adjust TC302 so that the waveform becomes flat.

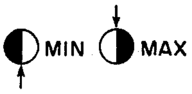
ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH3 Input Capacity	TC301	X75-1180	Connect the capacity meter to the CH3 input, and measure the input capacity in the 0.1 V range. Adjust TC301, so that the input capacity in the 0.5 V range equals the same capacity as in the 0.1 V range.
CH4 Waveform Shaping	TC402	X75-1180	Adjust in the same way for CH3.
CH4 Input Capacity	TC401	X75-1180	Adjust in the same way for CH3.
CH1 Square Wave Characteristics	TC101 TC501 VR502	X73-1760	CH1, 2 VOLTS : 10 mV CH1, 2 AC-GND-DC : DC SWEEP TIME/DIV : 1 μs ×10 MAG : ON • Input a 1 MHz square wave signal into CH1 (with a CRT amplitude of 6 div.). * Adjust TC101 so that the overshoot is maximized. * Set a TC or the VR to an adjustment angle as shown in Figure 1 or 2 to bring about ±0.2 division of the scale. • Input the 1 MHz square wave signal into CH2 (with the CRT amplitude of 6 div.). * Adjust TC201 so that the overshoot is maximized. * Set a TC or the VR to an adjustment angle as shown in Figure 1 to bring about ±0.2 division of the scale. 
	TC1 TC2 VR1	X80-1100	
	TC101	X75-1180	
CH2 Square Wave Characteristics	TC201 TC502 VR505	X73-1760	
	TC201	X75-1180	
CH3 Square Wave Characteristics	TC503 VR508	X73-1760	CH3, 4 : 0.1 V/div. * Set a TC or VR to an adjustment angle as shown in Figure 1 to bring about ±0.3 division of the scale. 
CH4 Square Wave Characteristics	TC504 VR511	X73-1760	

ADJUSTMENT



"MIN": Rotated fully counterclockwise
"MAX": Rotated fully clockwise



TC (without lock mechanism)
Counterclockwise rotation: Unclear waveform Under)
Clockwise rotation: Clear waveform (over)

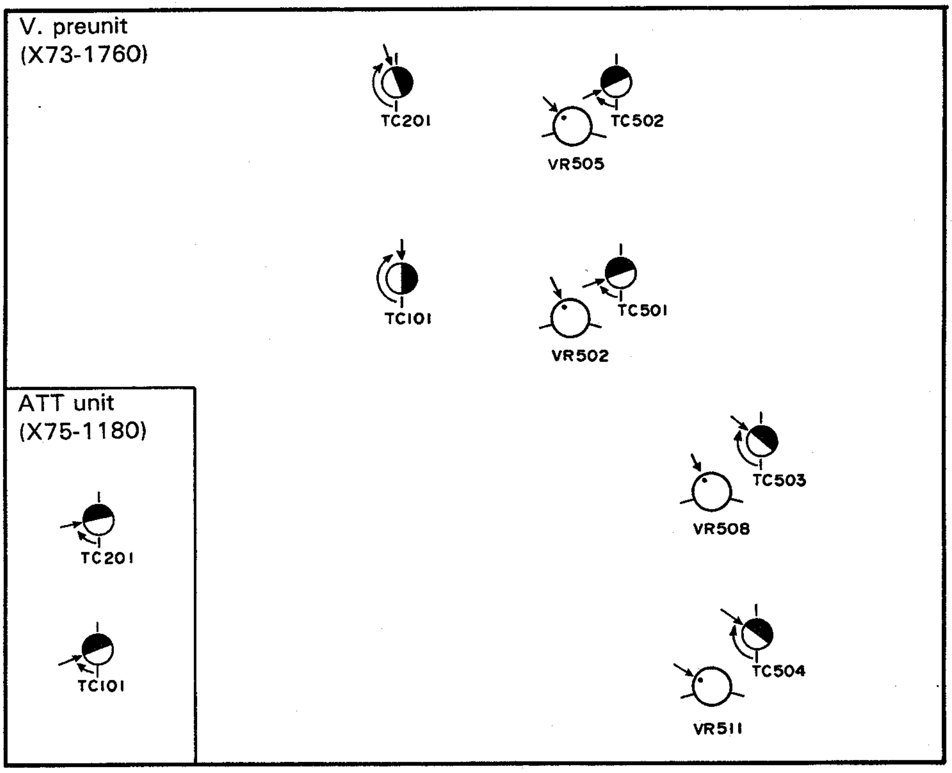

V. preunit
(X73-1760)
TC201
TC502
VR505
TC101
TC501
VR502
ATT unit
(X75-1180)
TC201
TC101
TC503
VR508
TC504
VR511

Fig. 1

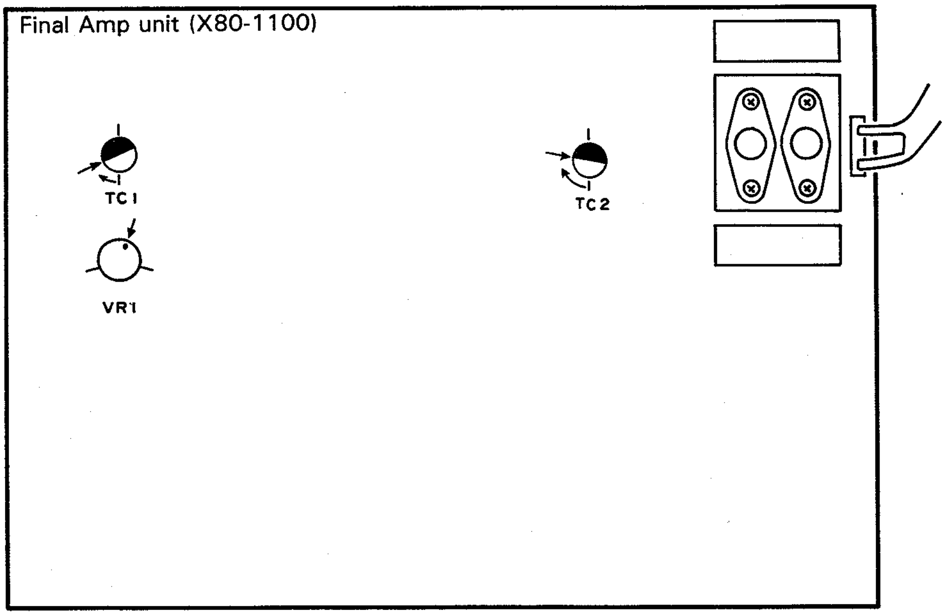

Final Amp unit (X80-1100)
TC1
VR1
TC2

Fig. 2

ADJUSTMENT

3. TRIGGER SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
FIX Level Center	VR1	X74-1480	TRIGGERING MODE : FIX SOURCE : CH1 COUPLING : AC CH1 VOLTS/DIV : 10 mV Input a 1 kHz sine wave into CH1, and adjust the oscillator so that the CRT amplitude becomes 6 div. Adjust VR1 so that start point of the luminescent line is at the center of the CRT (vertical direction).
A TRIG. DC Coupling	VR601(CH1) VR602(CH2) VR603(CH3) VR604(CH4)	X73-1760	After adjusting the trigger level center, set the TRIGGERING COUPLING to the DC position. Adjust VR601 so that the start point of the luminescent line is at the same position as in the AC mode.
B TRIG. Level Center	VR4	X74-1480	TRIGGERING MODE : AUTO SOURCE : CH2 COUPLING : AC LEVEL : Mechanical center CH2 VOLTS/DIV : 10 mV Input a 1 kHz sine wave to CH2, and adjust the oscillator so that the CRT amplitude becomes 6 div. Adjust VR4 so that start point of the luminescent line is at the center of the CRT (vertical direction).
B TRIG. DC coupling	VR3	X74-1480	Set the TRIGGERING COUPLING to the DC position. Adjust VR3 so that the start point of the luminescent line is at the same position as in the AC mode.

4. HORIZONTAL SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
A SWEEP Time	VR301	X74-1480	SWEEP TIME/DIV: 1 ms Input a 1 ms marker signal into CH1. Adjust VR301 so that the peak of the marker signal matches the CRT scale divided in 1 div.
	VR103	X74-1480	SWEEP TIME/DIV: 1 ms～5 ms Adjust VR103 in the same way as for 1 ms adjustment.
	VR307	X74-1480	SWEEP TIME/DIV: 1 ms Input a 1 ms marker signal into CH1, and match the peak of the marker signal with the CRT scale divided in 1 div. Set to the X10 MAG status, and adjust VR307 so that the interval between peaks becomes 10 div.
	VR103	X80-1100	SWEEP TIME/DIV: 0.2 μs Input a 0.2 μs marker signal into CH1. Set to the X10 MAG status, and adjust the horizontal POSITION so that the peak of the waveform is at the vertical scale line at the center of the CRT. Release the X10 MAG mode and adjust VR103 so that the peak of the waveform matches the vertical scale line at the center of the CRT.

ADJUSTMENT

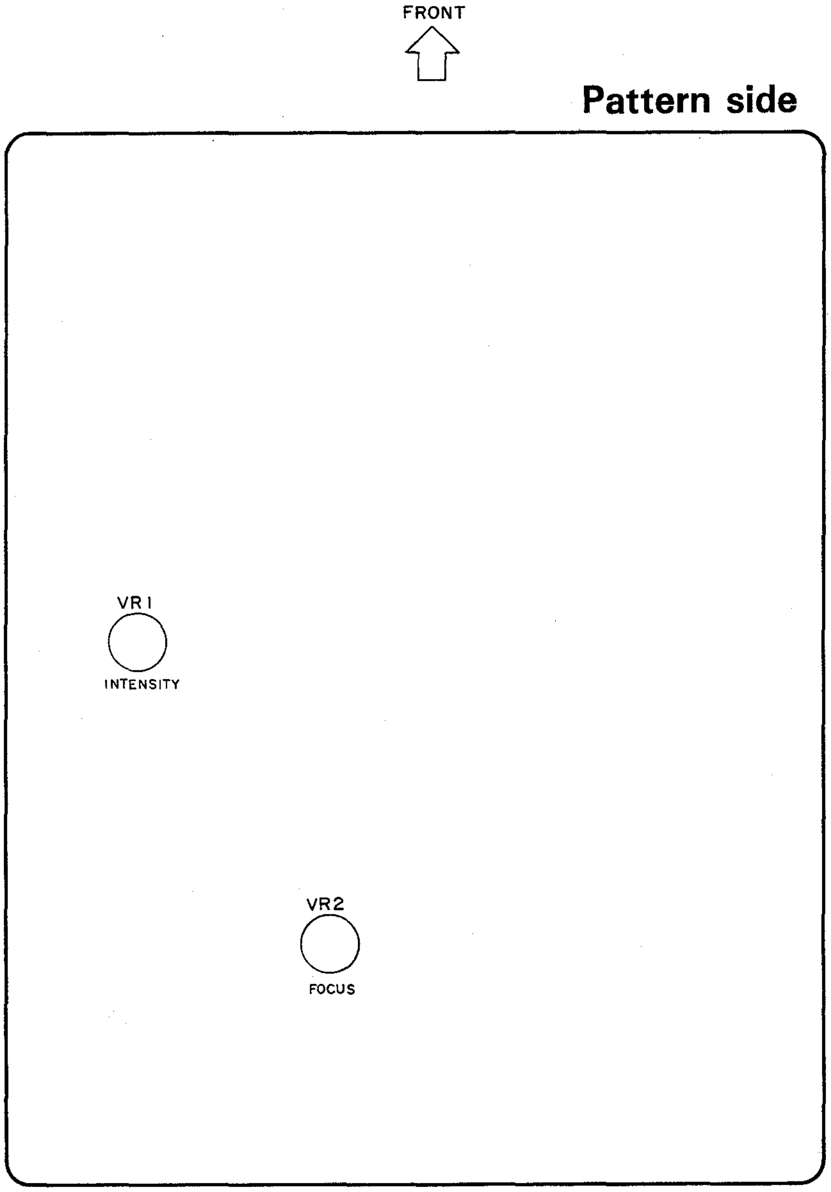
Item	Adjustment VR (TC)	P.C.B.	Procedure
B SWEEP Time	VR302	X74-1480	SWEEP TIME/DIV: 1 ms Input a 1 ms marker signal into CH1. Adjust VR302 so that the peak of the marker signal matches the CRT scale divided in 1 div.
	VR104	X74-1480	SWEEP TIME/DIV: 1 ms ~ 5 ms Input a 1 ms ~ 5 ms signal into CH1, and adjust in the same way as for 1 ms
	TC102	X74-1480	SWEEP TIME/DIV: 2 μs Input a 2 μs marker signal into CH1, and adjust in the same way as for 1 ms adjustment.
	TC303	X74-1480	SWEEP TIME/DIV: 20 ns Input a 20 ns marker signal into CH1, and adjust in the same way as for 1 ms adjustment.
A Sweep Position	VR304	X74-1480	HORIZ. MODE : A SOURCE : VERT VERTICAL MODE : CH1 A SWEEP TIME/DIV : 0.5 ms TRIG. MODE : AUTO Apply a 0.5 ms marker signal to CH1 to display a waveform to the center of the CRT screen. Rotate the ◄► POSITION control to maximum clockwise. Measure the deviation between the starting point of the trace and the center of the graticule line. Next, rotate the ◄► POSITION control to maximum counterclockwise and measure the distance between the 12th peak of the waveform and the center of the graticule line. Adjust VR304 so that these deviations will have the same width.
B Sweep Position	VR305	X74-1480	HORIZ. MODE : ALT SLOPE : + A, B INTEN : Fully counterwise Operate ▲▼ TRACE SEP control to separate the A sweep and B sweep. Set the A VARIABLE to CAL. Adjust VR305 to align the starting point of B sweep with that of A sweep in the horizontal position.
X Gain	VR303	X74-1480	CH2 VOLTS/DIV : 10 mV TRIGGERING MODE : X-Y Input the square wave signal having an amplitude of 50 mV into CH2, and adjust VR303 so that the CRT amplitude in the horizontal direction becomes 5 div.
X Position	VR306	X74-1480	VERTICAL MODE : CH2 CH2 AC-GND-DC : GND Set the scope controls to display a trace to the graticule center. Adjust VR306 to position to trace to horizontal graticule when switched the HORIZ, MODE switch to X-Y position. Clockwise rotation of channel 2 position control should move up to 5 divisions upward and counterclockwise rotation should move up to 5 divisions downward.

ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
Delay time	VR101 VR102	X74-1480	HORIZ. MODE : ALT CH1 AC-GND-DC : GND A SWEEP TIME/DIV : 1 ms B SWEEP TIME/DIV : 0.2 μs Rotate the DELAY POSITION control to 0.20 position and set the scope controls to coincide A trace with the left end of the graticule scale, using the horizontal position control. Adjust VR101 to position B trace (intensified portion) to 0.2 div position. Adjust VR102 to position B trace to 10 div. position (right end of the graticule scale) when rotated the DELAY POSITION control to 10.00 position.
CAL Voltage	VR5 VR6	X81-2330	Apply a CAL signal to channel 1 input. Adjust VR5 so that one period becomes 0.1 ms (10 div). Adjust VR6 so that the amplitude becomes 0.2 V (5 div.)

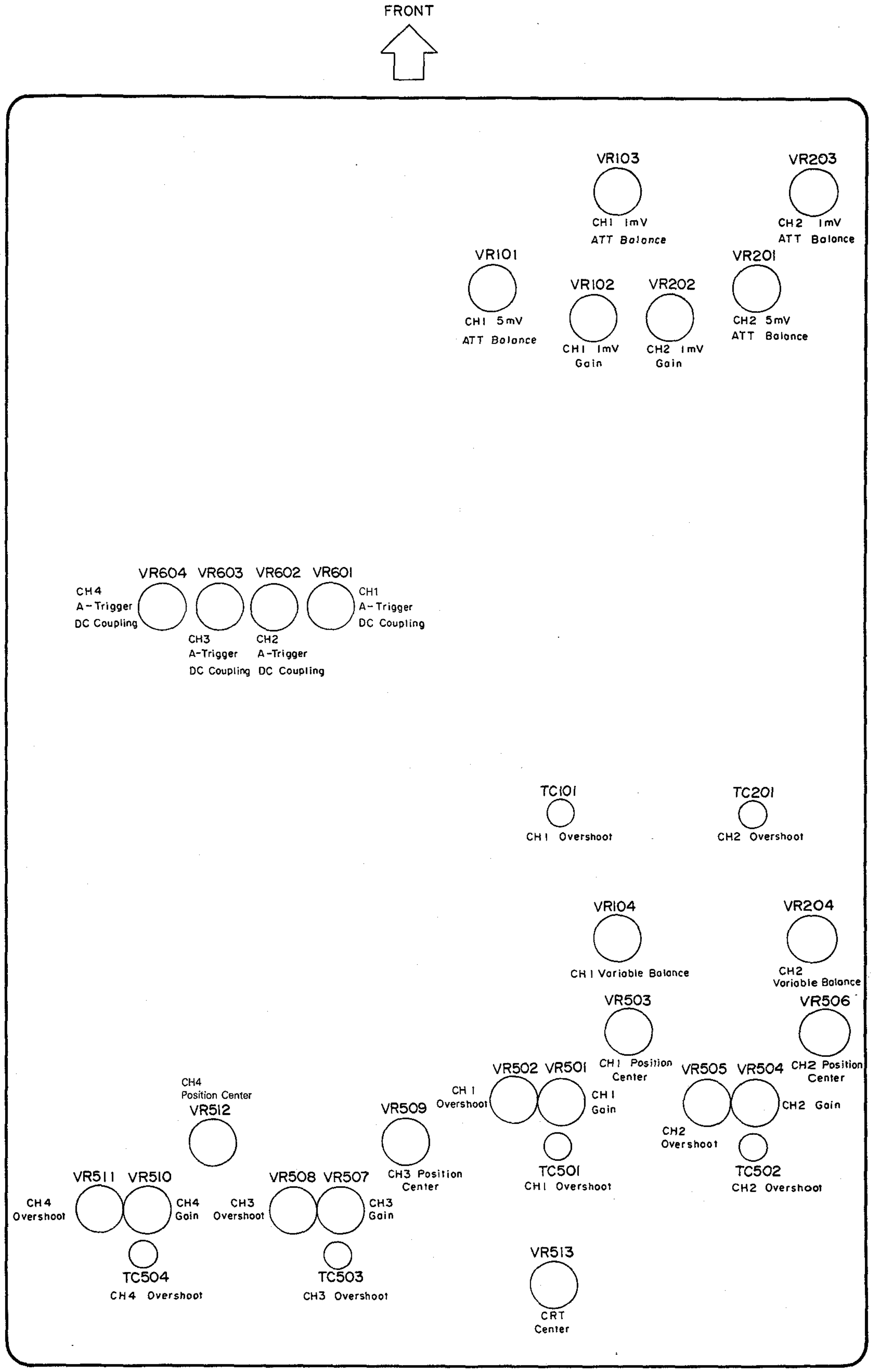
ADJUSTMENT

HIGH VOLTAGE UNIT (X68-1510-00)


FRONT
Pattern side
VR1
INTENSITY
VR2
FOCUS

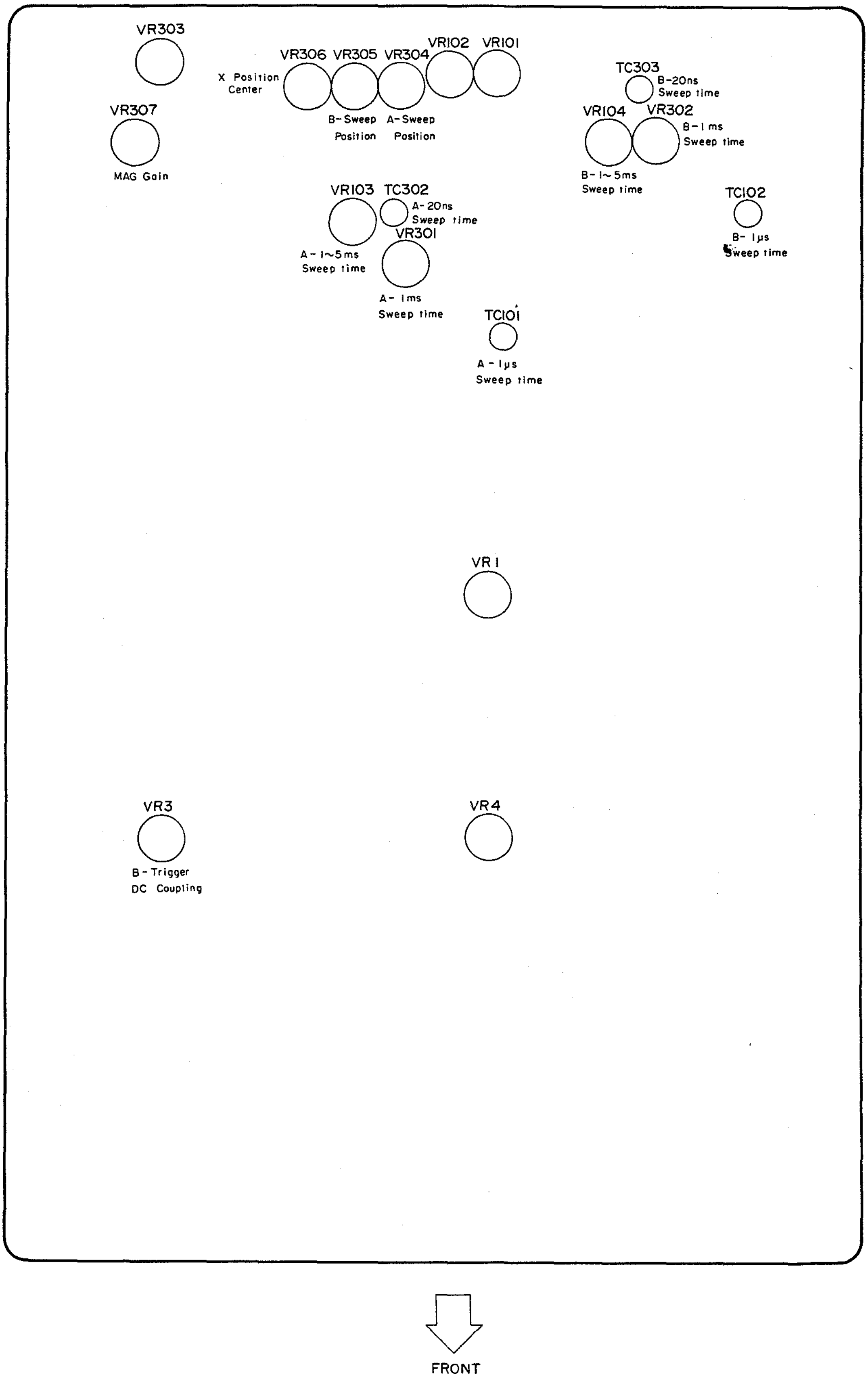
ADJUSTMENT

VERTICAL PRE AMPLIFIER UNIT (X73-1760-00)


FRONT
VR103
CH1 1mV
ATT Balance
VR203
CH2 1mV
ATT Balance
VR101
CH1 5mV
ATT Balance
VR102
CH1 1mV
Gain
VR202
CH2 1mV
Gain
VR201
CH2 5mV
ATT Balance
VR604
CH4
A-Trigger
DC Coupling
VR603
CH3
A-Trigger
DC Coupling
VR602
CH2
A-Trigger
DC Coupling
VR601
CH1
A-Trigger
DC Coupling
TC101
CH1 Overshoot
TC201
CH2 Overshoot
VR104
CH1 Variable Balance
VR204
CH2
Variable Balance
VR503
CH1 Position
Center
VR506
CH2 Position
Center
VR502
CH1
Overshoot
VR501
CH1
Gain
TC501
CH1 Overshoot
VR505
CH2
Overshoot
VR504
CH2 Gain
TC502
CH2 Overshoot
CH4
Position Center
VR512
VR509
CH3 Position
Center
VR511
CH4
Overshoot
VR510
CH4
Gain
TC504
CH4 Overshoot
VR508
CH3
Overshoot
VR507
CH3
Gain
TC503
CH3 Overshoot
VR513
CRT
Center

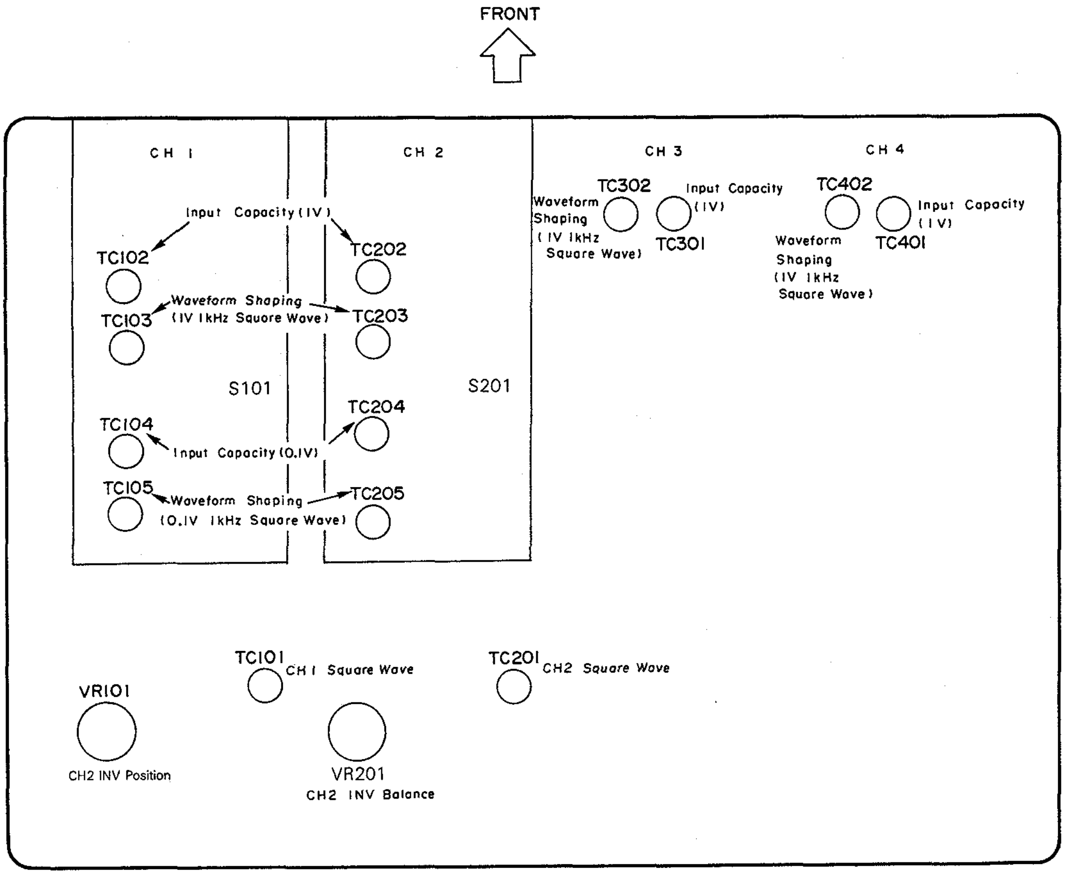
ADJUSTMENT

HORIZONTAL UNIT (X74-1480-00)

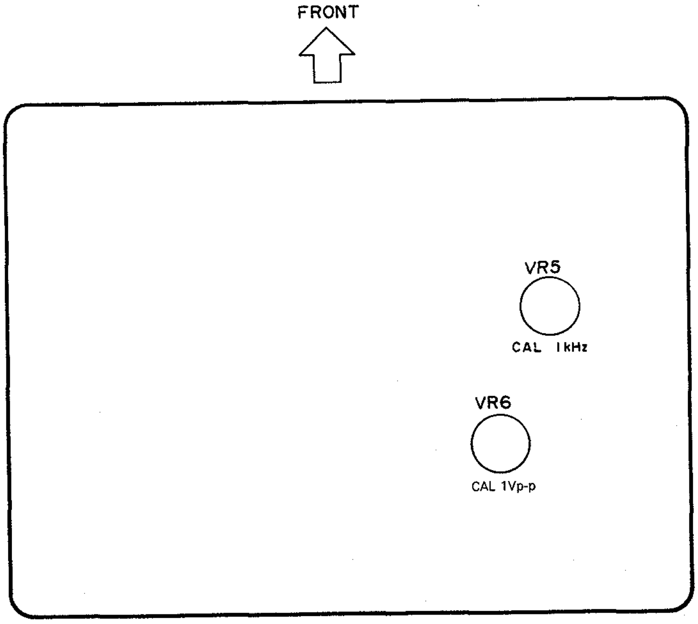

VR303
VR306
VR305
VR304
VR102
VR101
X Position Center
B-Sweep Position
A-Sweep Position
VR307
MAG Gain
TC303
B-20ns Sweep time
VR104
VR302
B-1 ms Sweep time
B-1~5ms Sweep time
VR103
TC302
A-20ns Sweep time
VR301
A-1~5ms Sweep time
A-1ms Sweep time
TC102
B-1μs Sweep time
TC101
A-1μs Sweep time
VR1
VR3
B-Trigger DC Coupling
VR4
FRONT

ADJUSTMENT

ATT UNIT (X75-1180-00)

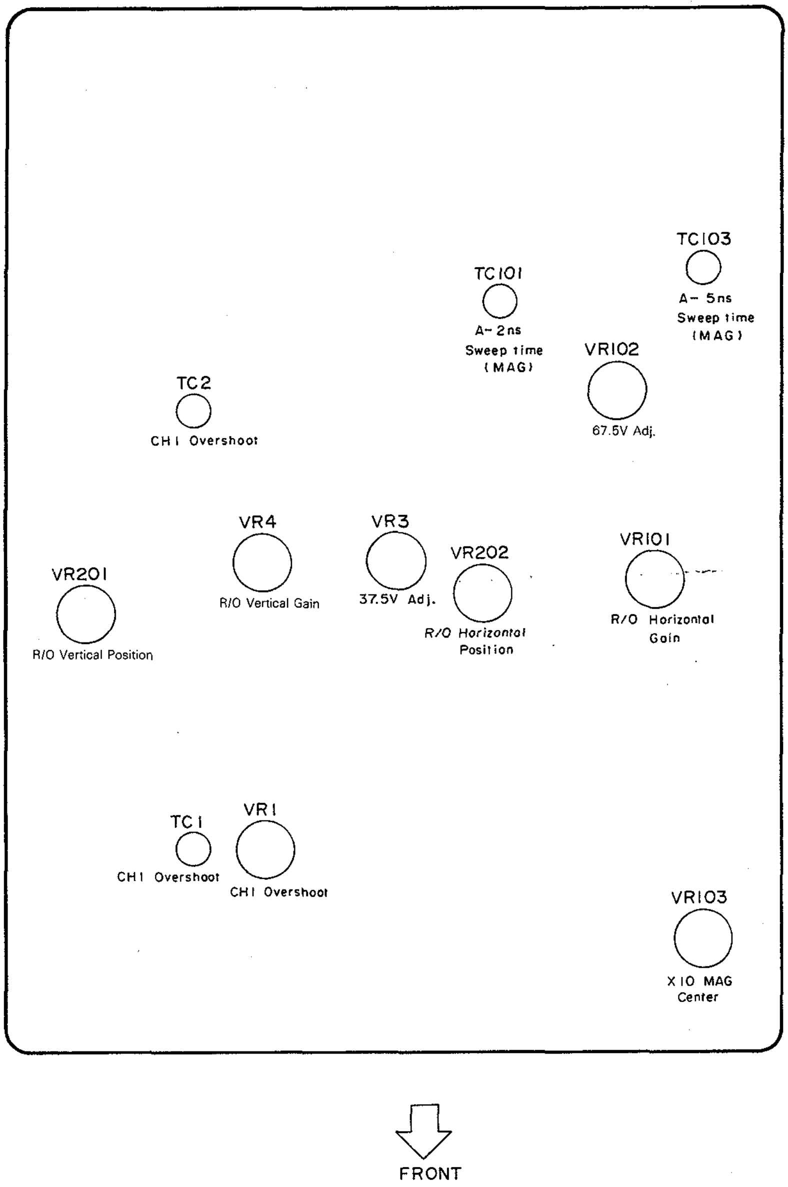

FRONT
CH 1
CH 2
CH 3
CH 4
Input Capacity (1V)
TC102
TC202
Waveform Shaping (1V 1kHz Square Wave)
TC103
TC203
S101
S201
TC104
TC204
Input Capacity (0.1V)
TC105
TC205
Waveform Shaping (0.1V 1kHz Square Wave)
TC302
Waveform Shaping (1V 1kHz Square Wave)
Input Capacity (1V)
TC301
TC402
Waveform Shaping (1V 1kHz Square Wave)
Input Capacity (1V)
TC401
TC101
CH 1 Square Wave
TC201
CH2 Square Wave
VR101
CH2 INV Position
VR201
CH2 INV Balance

VOLUME UNIT (X81-2330-00)


FRONT
VR5
CAL 1kHz
VR6
CAL 1Vp-p

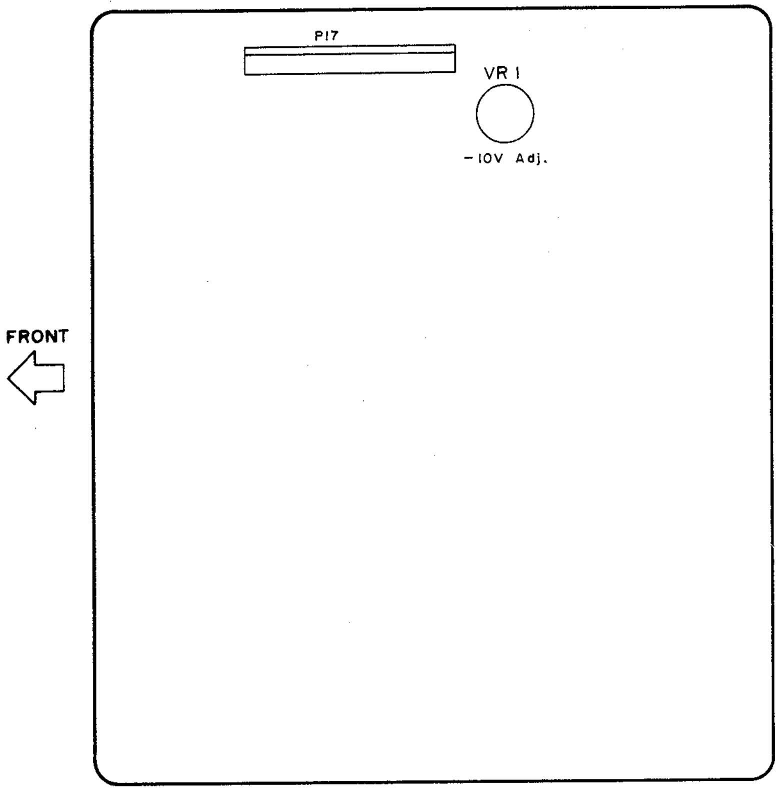
ADJUSTMENT

FINAL AMP UNIT (X80-1100-00)

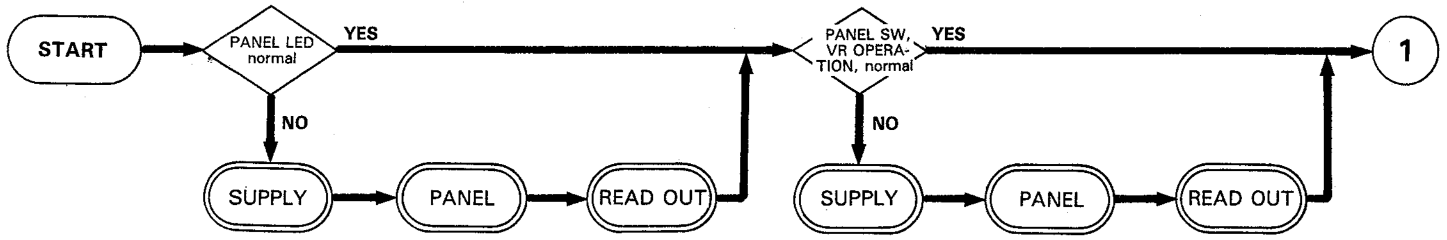

TC103
A– 5ns
Sweep time
(MAG)
TC101
A– 2ns
Sweep time
(MAG)
VR102
67.5V Adj.
TC2
CH1 Overshoot
VR4
R/O Vertical Gain
VR3
37.5V Adj.
VR202
R/O Horizontal
Position
VR101
R/O Horizontal
Gain
VR201
R/O Vertical Position
TC1
CH1 Overshoot
VR1
CH1 Overshoot
VR103
X10 MAG
Center
FRONT

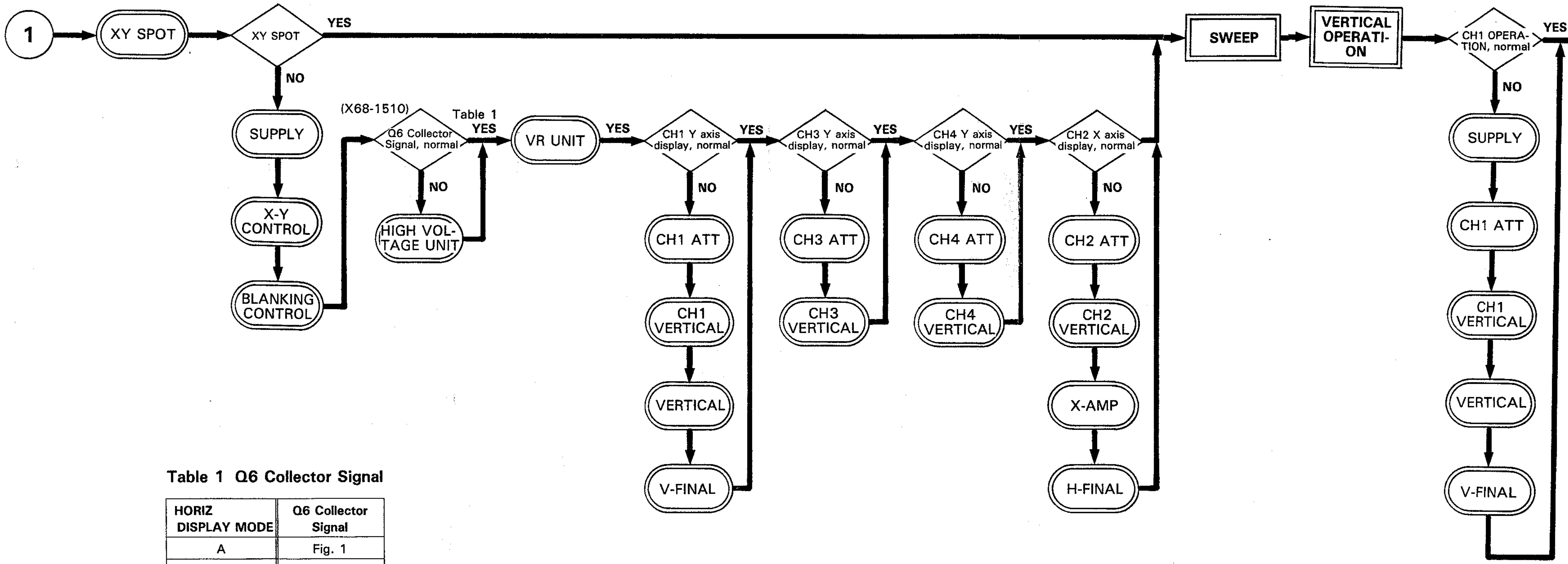
ADJUSTMENT

POWER SUPPLY UNIT (X68-1500-00)


P17
VR 1
−10V Adj.
FRONT

TROUBLESHOOTING


START
PANEL LED normal
YES
NO
SUPPLY
PANEL
READ OUT
PANEL SW, VR OPERATION, normal
YES
NO
SUPPLY
PANEL
READ OUT
1


1
XY SPOT
XY SPOT
YES
NO
SUPPLY
X-Y CONTROL
BLANKING CONTROL
(X68-1510)
Table 1
Q6 Collector Signal, normal
YES
NO
HIGH VOLTAGE UNIT
VR UNIT
YES
CH1 Y axis display, normal
YES
NO
CH1 ATT
CH1 VERTICAL
VERTICAL
V-FINAL
CH3 Y axis display, normal
YES
NO
CH3 ATT
CH3 VERTICAL
CH4 Y axis display, normal
YES
NO
CH4 ATT
CH4 VERTICAL
CH2 X axis display, normal
NO
CH2 ATT
CH2 VERTICAL
X-AMP
H-FINAL
SWEEP
VERTICAL OPERATION
CH1 OPERATION, normal
YES
NO
SUPPLY
CH1 ATT
CH1 VERTICAL
VERTICAL
V-FINAL

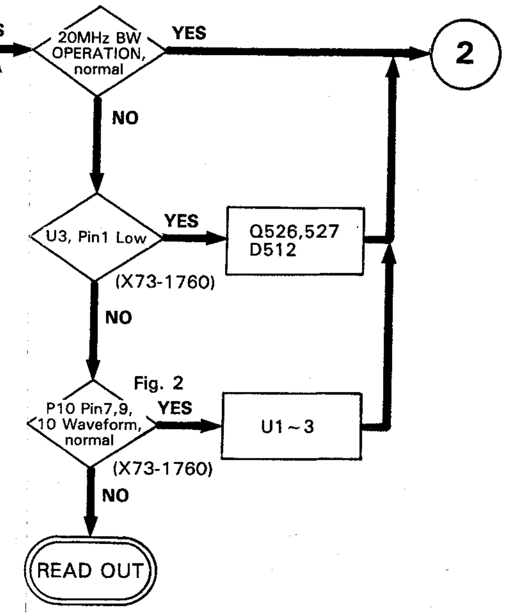

20MHz BW OPERATION, normal
YES
NO
2
U3, Pin1 Low
YES
Q526,527
D512
(X73-1760)
NO
Fig. 2
P10 Pin7,9, 10 Waveform, normal
YES
U1~3
(X73-1760)
NO
READ OUT

Table 1 Q6 Collector Signal

HORIZ DISPLAY MODE	Q6 Collector Signal
A	Fig. 1
A INT B AFT. D	Fig. 1
ALT AFT. D	Fig. 1
B AFT. D	Fig. 1
X-Y	30 ~ 60V

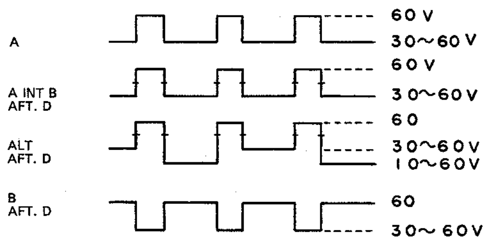


Fig. 1 Q6 Collector Signal

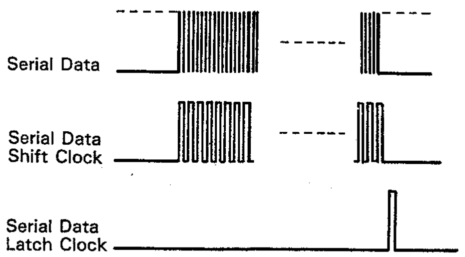
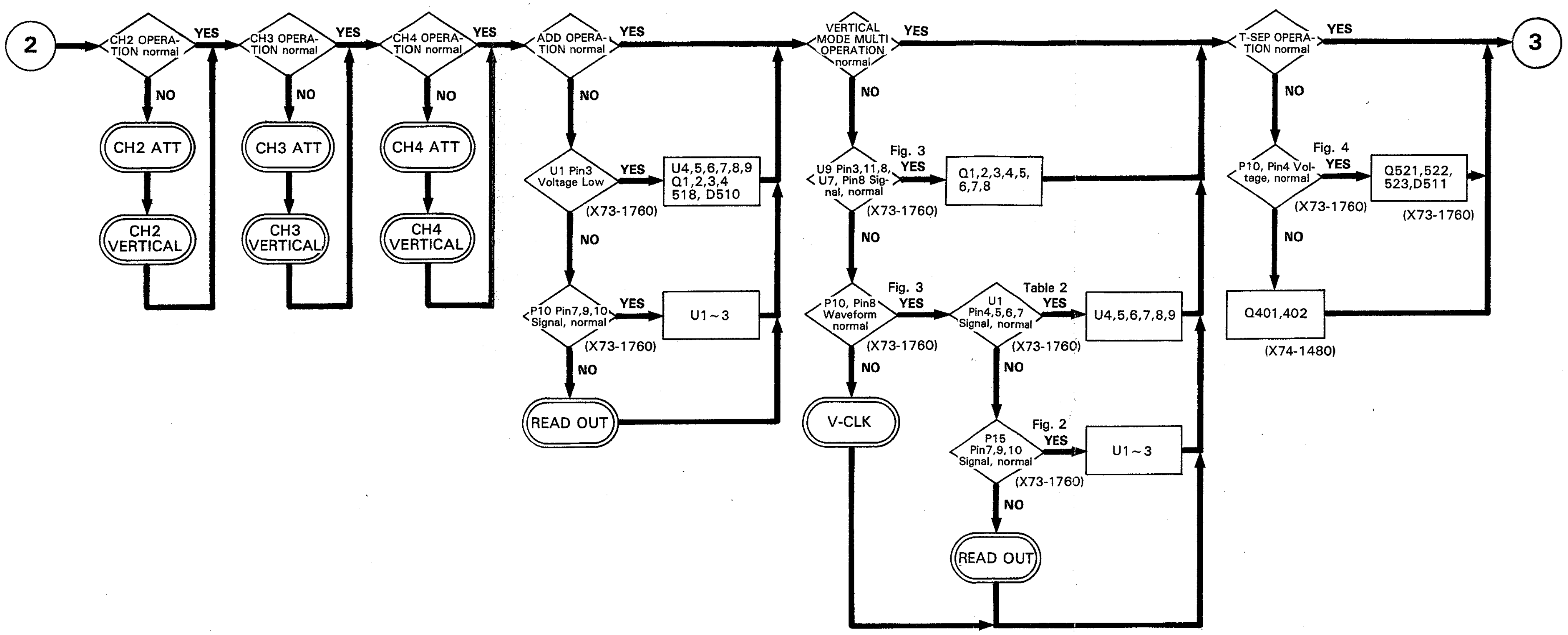
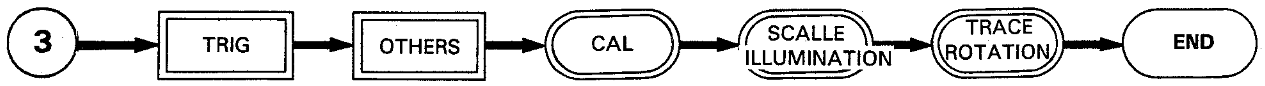


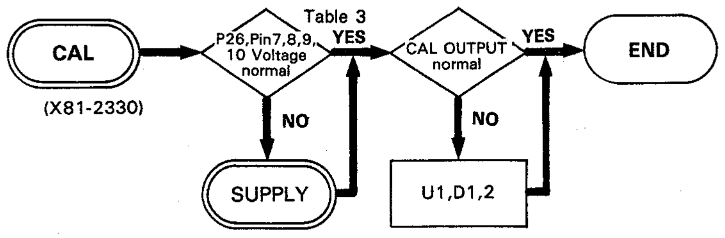
Fig. 2 Serial transmit timing chart

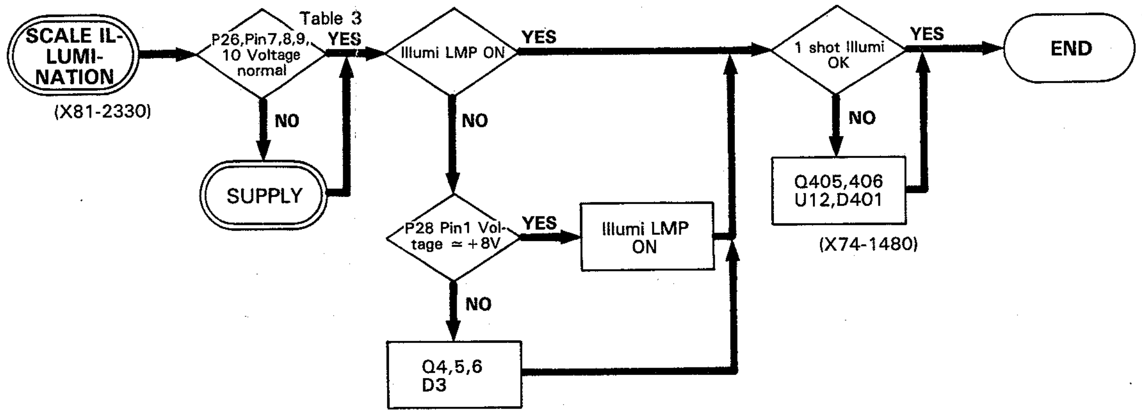
	Panel SW SCAN	Panel LED Control	ATT UNIT Control	V UNIT Control	H UNIT Control
Serial Data	P1 Pin 4 (SD)	P1 Pin 1 (LD)	P4 Pin 9 (AD)	U16 Pin 16 (VD)	U16 Pin 19 (HD)
Serial Data Shift Clock	P1 Pin 5 (SSC)	P1 Pin 2 (LSC)	P4 Pin 8 (ASC)	U9 Pin 14 (VSC)	U9 Pin 10 (HSC)
Serial Data Latch Clock	P1 Pin 6 (SLC)	P1 Pin 3 (LLC)	P4 Pin 7 (ALC)	U8 Pin 11 (VLC)	U8 Pin 7 (HLC)

TROUBLESHOOTING

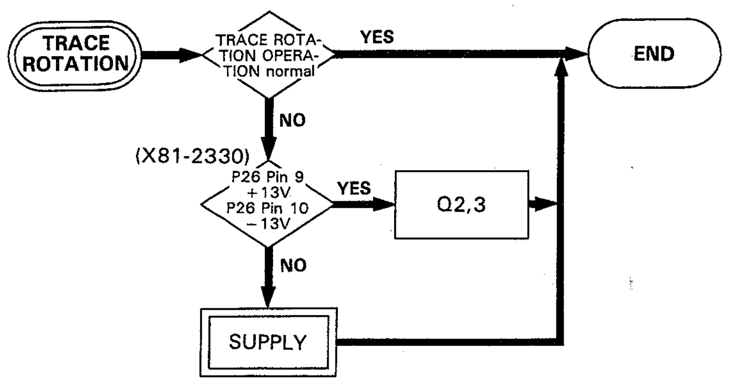

2
CH2 OPERATION normal
YES
NO
CH2 ATT
CH2 VERTICAL
CH3 OPERATION normal
YES
NO
CH3 ATT
CH3 VERTICAL
CH4 OPERATION normal
YES
NO
CH4 ATT
CH4 VERTICAL
ADD OPERATION normal
YES
NO
U1 Pin3 Voltage Low
YES
U4,5,6,7,8,9 Q1,2,3,4 518, D510
(X73-1760)
NO
P10 Pin7,9,10 Signal, normal
YES
U1~3
(X73-1760)
NO
READ OUT
VERTICAL MODE MULTI OPERATION normal
YES
NO
Fig. 3
U9 Pin3,11,8, U7, Pin8 Signal, normal
YES
Q1,2,3,4,5, 6,7,8
(X73-1760)
NO
Fig. 3
P10, Pin8 Waveform normal
YES
(X73-1760)
NO
V-CLK
Table 2
U1 Pin4,5,6,7 Signal, normal
YES
U4,5,6,7,8,9
(X73-1760)
NO
Fig. 2
P15 Pin7,9,10 Signal, normal
YES
U1~3
(X73-1760)
NO
READ OUT
T-SEP OPERATION normal
YES
NO
Fig. 4
P10, Pin4 Voltage, normal
YES
Q521,522, 523,D511
(X73-1760)
(X73-1760)
NO
Q401,402
(X74-1480)
3

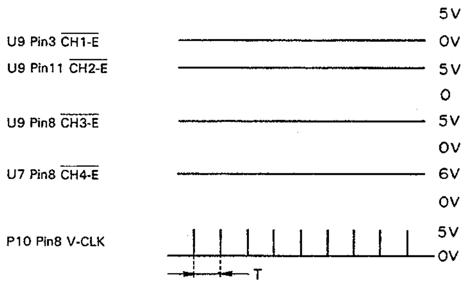

3
TRIG
OTHERS
CAL
SCALLE ILLUMINATION
TRACE ROTATION
END


CAL
(X81-2330)
Table 3
P26,Pin7,8,9, 10 Voltage normal
YES
NO
SUPPLY
CAL OUTPUT normal
YES
NO
U1,D1,2
END

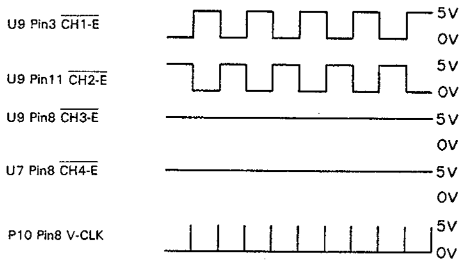

SCALE ILLUMINATION
(X81-2330)
Table 3
P26,Pin7,8,9, 10 Voltage normal
YES
NO
SUPPLY
Illumi LMP ON
YES
NO
P28 Pin1 Voltage ≈ +8V
YES
Illumi LMP ON
NO
Q4,5,6 D3
1 shot Illumi OK
YES
NO
Q405,406 U12,D401
(X74-1480)
END

TROUBLESHOOTING

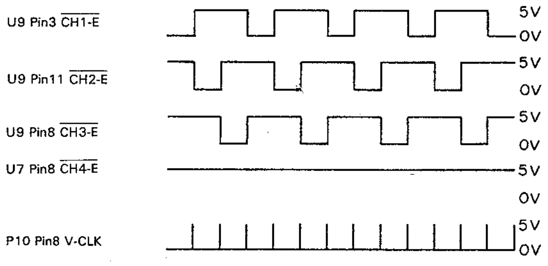

TRACE ROTATION
TRACE ROTATION OPERATION normal
YES
END
NO
(X81-2330)
P26 Pin 9 +13V P26 Pin 10 −13V
YES
Q2,3
NO
SUPPLY


U9 Pin3 CH1-E
U9 Pin11 CH2-E
U9 Pin8 CH3-E
U7 Pin8 CH4-E
P10 Pin8 V-CLK
5V
0V
5V
0
5V
0V
6V
0V
5V
0V
T

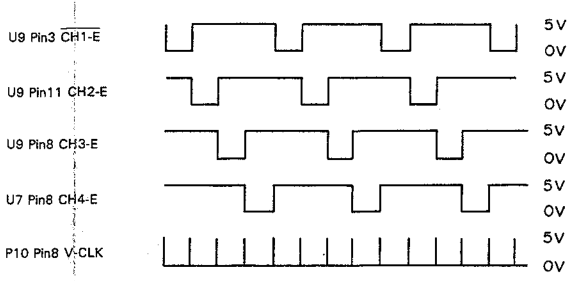
(a) CH1 SELECT


U9 Pin3 CH1-E
U9 Pin11 CH2-E
U9 Pin8 CH3-E
U7 Pin8 CH4-E
P10 Pin8 V-CLK
5V
0V
5V
0V
5V
0V
5V
0V
5V
0V

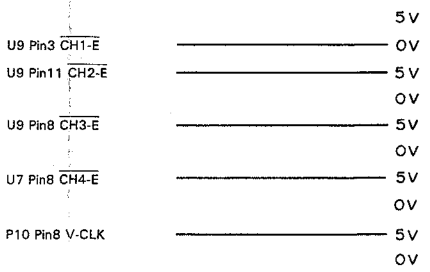
(b) CH1, CH2 SELECT


U9 Pin3 CH1-E
U9 Pin11 CH2-E
U9 Pin8 CH3-E
U7 Pin8 CH4-E
P10 Pin8 V-CLK
5V
0V
5V
0V
5V
0V
5V
0V
5V
0V

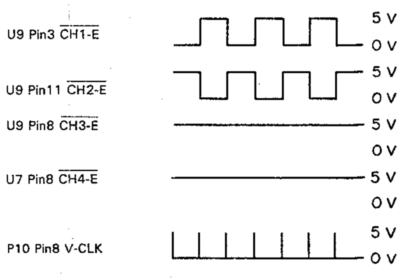
(c) CH1, CH2, CH3 SELECT


U9 Pin3 CH1-E
U9 Pin11 CH2-E
U9 Pin8 CH3-E
U7 Pin8 CH4-E
P10 Pin8 V-CLK
5V
0V
5V
0V
5V
0V
5V
0V
5V
0V

(d) CH1, CH2, CH3, CH4 SELECT


U9 Pin3 CH1-E
U9 Pin11 CH2-E
U9 Pin8 CH3-E
U7 Pin8 CH4-E
P10 Pin8 V-CLK
5V
0V
5V
0V
5V
0V
5V
0V
5V
0V

(e) X-Y CH1 SELECT


U9 Pin3 CH1-E
U9 Pin11 CH2-E
U9 Pin8 CH3-E
U7 Pin8 CH4-E
P10 Pin8 V-CLK
5V
0V
5V
0V
5V
0V
5V
0V
5V
0V

(f) X-Y CH1, CH2 SELECT

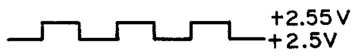
Fig. 3 VERTICAL CH SELECT WAVEFORM

T: H-MODE A, A INT B, B, X-Y
42 μs: 24kHz

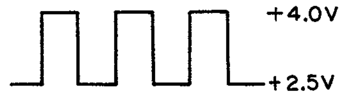
T: H-MODE ALT
84 μs: 12kHz

Table 2 U1, CH SELECT Voltage

CH SELECT	U1				
	Pin3	Pin4	Pin5	Pin6	Pin7
CH1					L
CH2				L	
CH3			L		
CH4		L			
ADD	LOW				



(a) FULLY CW



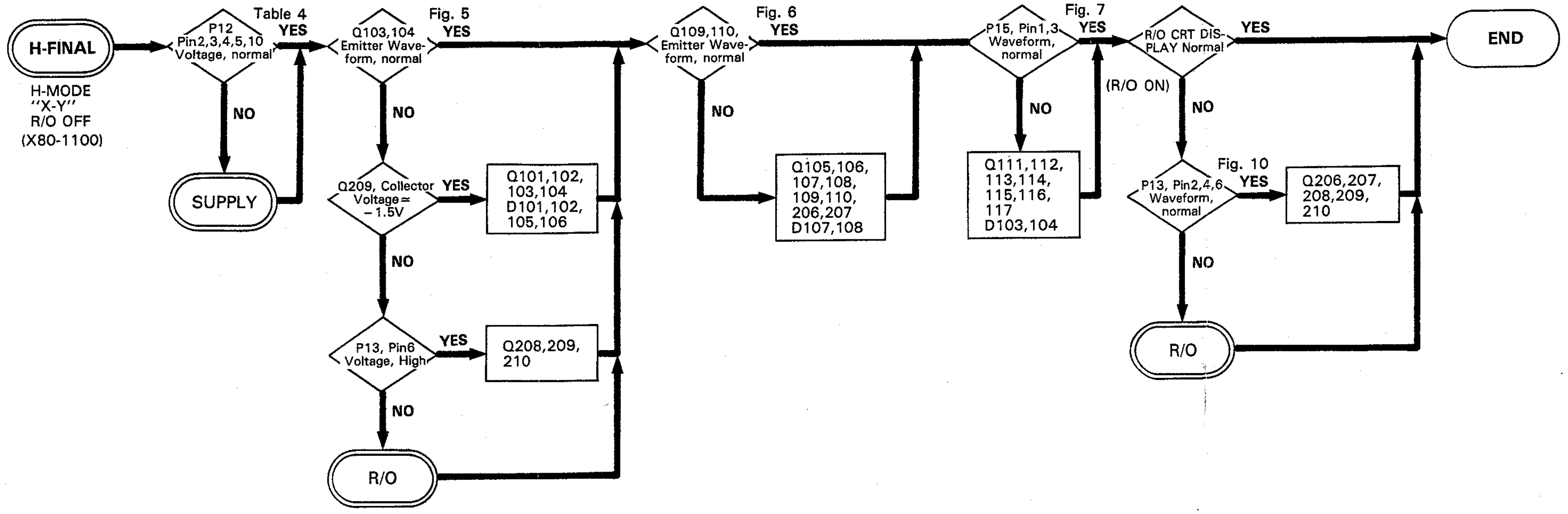
(b) FULLY CCW

Fig. 4 P10, Pin4 Waveform

Table 3 Voltage

P26 Pin No.	Voltage [V]
7	+10
8	−10
9	+13
10	−13

TROUBLESHOOTING


H-FINAL
H-MODE
"X-Y"
R/O OFF
(X80-1100)
Table 4
P12 Pin2,3,4,5,10 Voltage, normal
YES
NO
SUPPLY
Fig. 5
Q103,104 Emitter Waveform, normal
YES
NO
Q209, Collector Voltage ≈ −1.5V
YES
Q101,102, 103,104 D101,102, 105,106
NO
P13, Pin6 Voltage, High
YES
Q208,209, 210
NO
R/O
Fig. 6
Q109,110, Emitter Waveform, normal
YES
NO
Q105,106, 107,108, 109,110, 206,207 D107,108
Fig. 7
P15, Pin1,3 Waveform, normal
YES
NO
Q111,112, 113,114, 115,116, 117 D103,104
(R/O ON)
R/O CRT DISPLAY Normal
YES
NO
Fig. 10
P13, Pin2,4,6 Waveform, normal
YES
Q206,207, 208,209, 210
NO
R/O
END

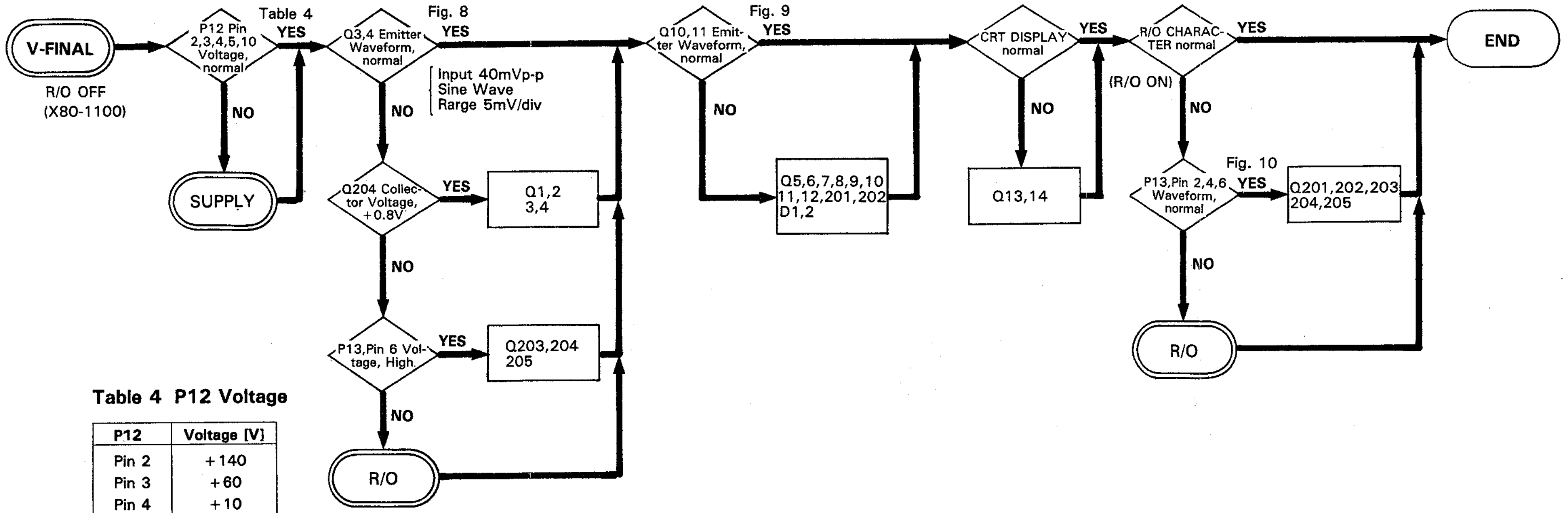

V-FINAL
R/O OFF
(X80-1100)
Table 4
P12 Pin 2,3,4,5,10 Voltage, normal
YES
NO
SUPPLY
Fig. 8
Q3,4 Emitter Waveform, normal
YES
Input 40mVp-p
Sine Wave
Rarge 5mV/div
NO
Q204 Collector Voltage, +0.8V
YES
Q1,2 3,4
NO
P13,Pin 6 Voltage, High
YES
Q203,204 205
NO
R/O
Fig. 9
Q10,11 Emitter Waveform, normal
YES
NO
Q5,6,7,8,9,10 11,12,201,202 D1,2
CRT DISPLAY normal
YES
NO
Q13,14
(R/O ON)
R/O CHARACTER normal
YES
NO
Fig. 10
P13,Pin 2,4,6 Waveform, normal
YES
Q201,202,203 204,205
NO
R/O
END

Table 4 P12 Voltage

P12	Voltage [V]
Pin 2	+140
Pin 3	+60
Pin 4	+10
Pin 5	−10
Pin10	+15

TROUBLESHOOTING

H-MODE "X-Y"
CH2 Input: 40mVp-p 1kHz Sine Ware
Volts/div: 5mV/div

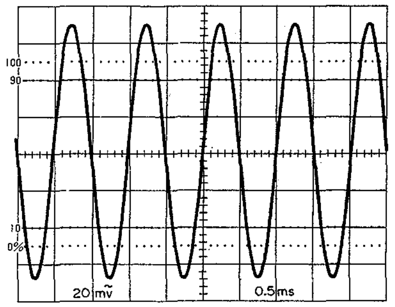


Fig. 5 DC −0.3V

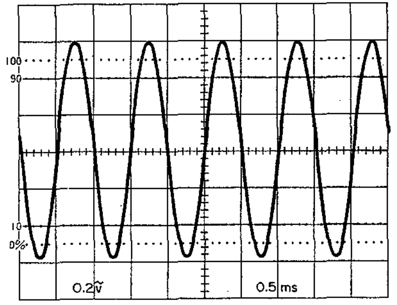


Fig. 6 DC −4V

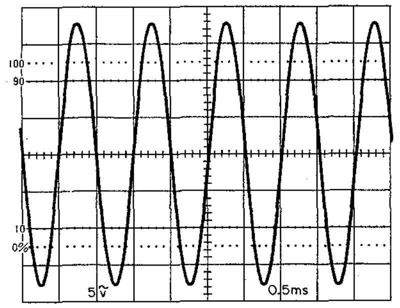
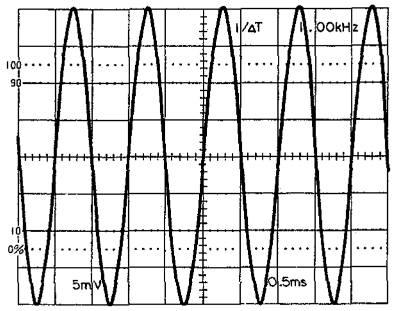


Fig. 7 DC +70V

Input: 40mVp-p, 1 kHz
Sine Wave
Volts/div: 5mV/div



CRT

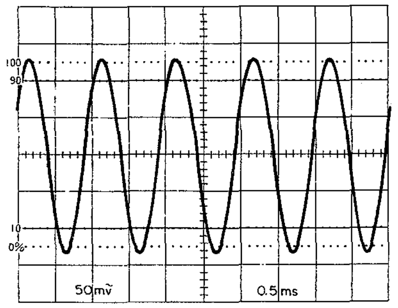


Fig. 8 DC +2.6V

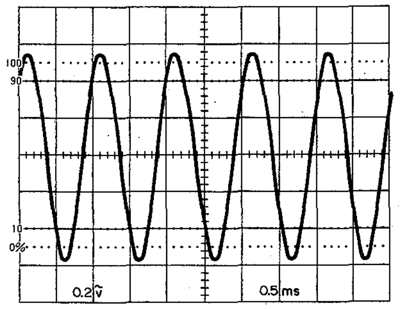
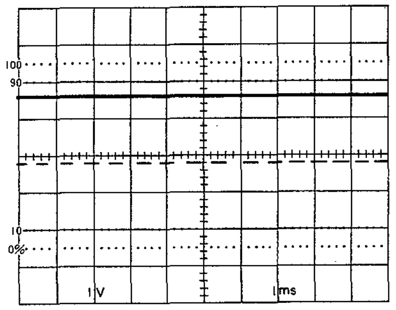
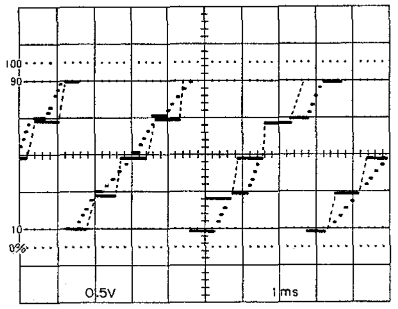


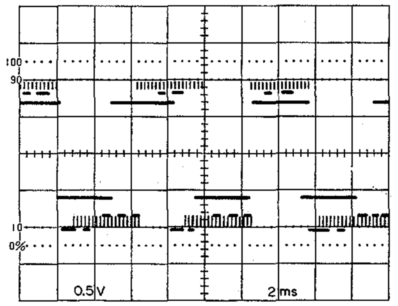
Fig. 9 DC +3.7V



Pin 6



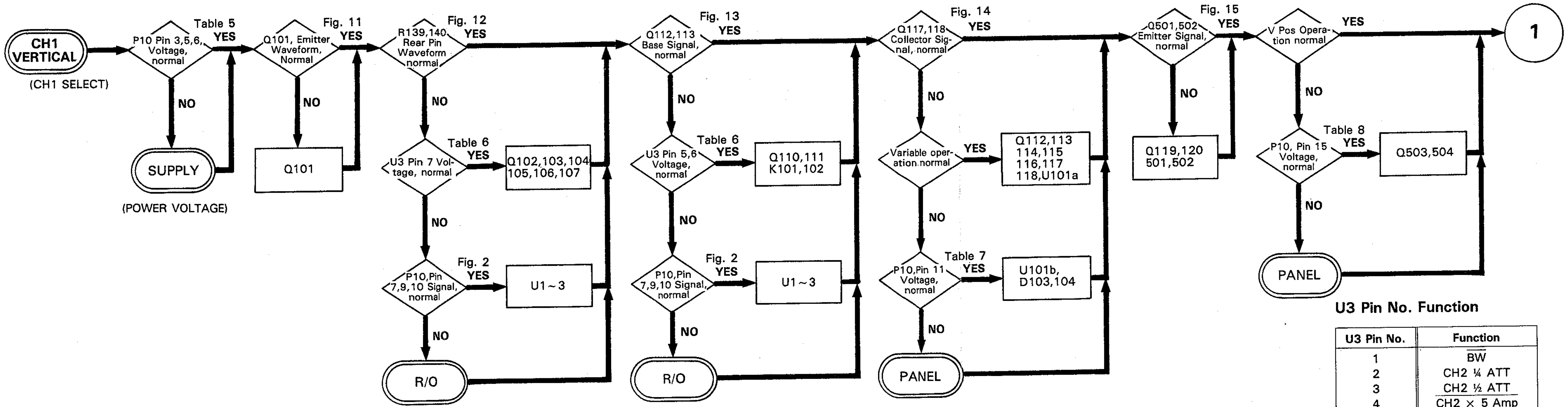
Pin 4



Pin 2

Fig. 10 P13. R/O Signal (R/O ON)

TROUBLESHOOTING


CH1 VERTICAL
(CH1 SELECT)
Table 5
P10 Pin 3,5,6, Voltage, normal
YES
NO
SUPPLY
(POWER VOLTAGE)
Fig. 11
Q101, Emitter Waveform, Normal
YES
NO
Q101
Fig. 12
R139,140, Rear Pin Waveform normal
YES
NO
Table 6
U3 Pin 7 Voltage, normal
YES
Q102,103,104 105,106,107
NO
Fig. 2
P10,Pin 7,9,10 Signal, normal
YES
U1~3
NO
R/O
Fig. 13
Q112,113 Base Signal, normal
YES
NO
Table 6
U3 Pin 5,6 Voltage, normal
YES
Q110,111 K101,102
NO
Fig. 2
P10,Pin 7,9,10 Signal, normal
YES
U1~3
NO
R/O
Fig. 14
Q117,118 Collector Signal, normal
YES
NO
Variable operation normal
YES
Q112,113 114,115 116,117 118,U101a
NO
Table 7
P10,Pin 11 Voltage, normal
YES
U101b, D103,104
NO
PANEL
Fig. 15
Q501,502 Emitter Signal, normal
YES
NO
Q119,120 501,502
V Pos Operation normal
YES
NO
Table 8
P10, Pin 15 Voltage, normal
YES
Q503,504
NO
PANEL
1

U3 Pin No. Function

U3 Pin No.	Function
1	$\overline{\text{BW}}$
2	CH2 ¼ ATT
3	CH2 ½ ATT
4	$\overline{\text{CH2 × 5 Amp}}$
5	CH1 ¼ ATT
6	CH1 ½ ATT
7	$\overline{\text{CH1 × 5 Amp}}$
15	—

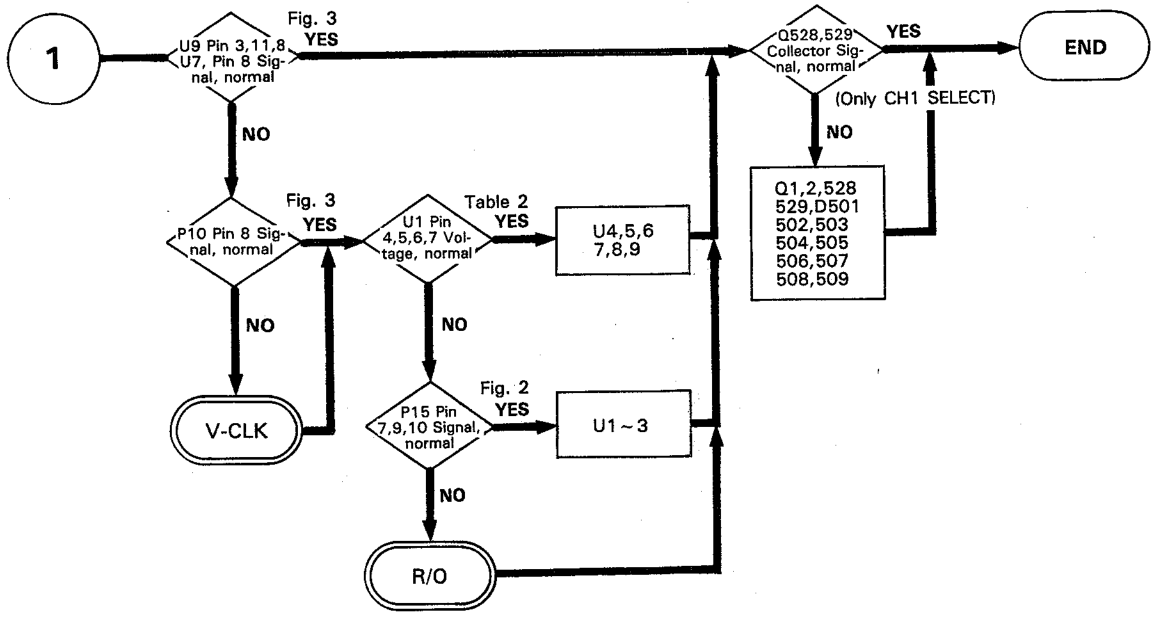

1
Fig. 3
U9 Pin 3,11,8, U7, Pin 8 Signal, normal
YES
NO
Fig. 3
P10 Pin 8 Signal, normal
YES
NO
V-CLK
Table 2
U1 Pin 4,5,6,7 Voltage, normal
YES
U4,5,6 7,8,9
NO
Fig. 2
P15 Pin 7,9,10 Signal, normal
YES
U1~3
NO
R/O
Q528,529 Collector Signal, normal
YES
END
(Only CH1 SELECT)
NO
Q1,2,528 529,D501 502,503 504,505 506,507 508,509

Table 5 Vpre Power Voltage

P10	Voltage [V]
Pin3	+10
Pin5	+ 5
Pin6	− 10

Table 6 U3 Pin Voltage

Volts/div	CH2			CH1		
	Pin2	Pin3	Pin4	Pin5	Pin6	Pin7
1 mV						
2		H			H	
5			H			H
10		H	H		H	H
20	H	H	H	H	H	H
50			H			H
0.1 V		H	H		H	H
0.2	H	H	H	H	H	H
0.5			H			H
1.0		H	H		H	H
2.0	H	H	H	H	H	H
5.0			H			H

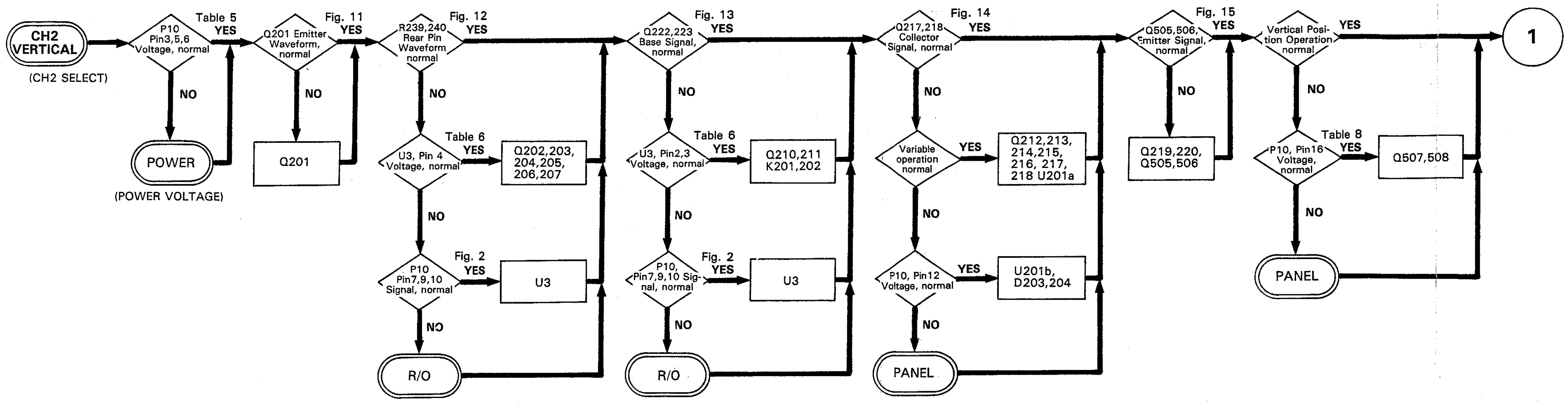
Table 7 P10 CAL ~ UNCAL

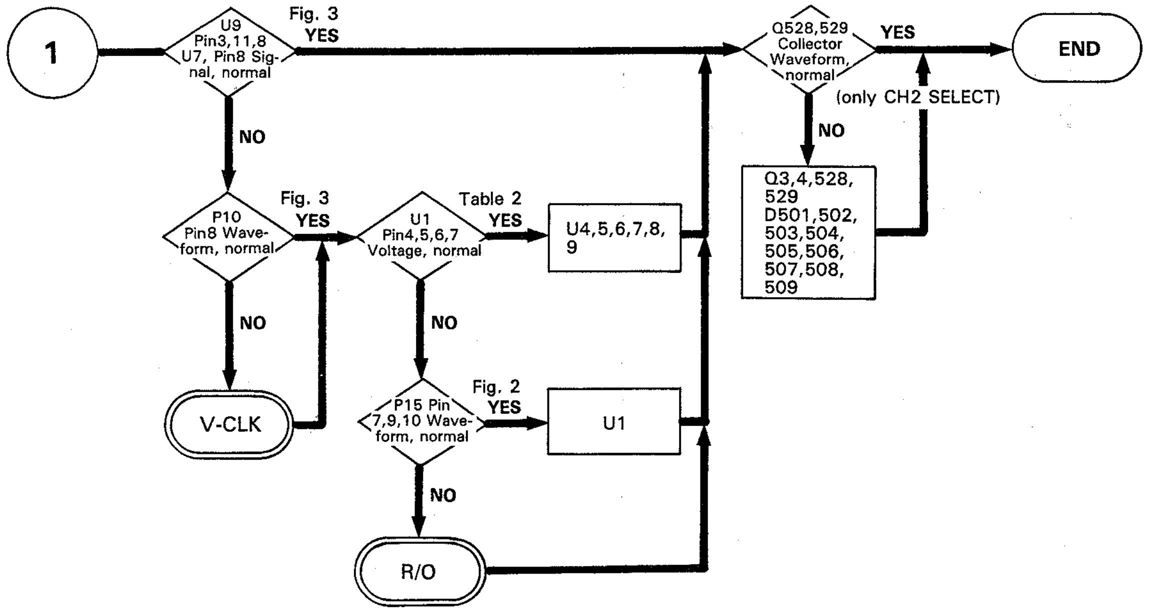
P10	CAL ~ UNCAL
Pin11	0 ~ +10V
Pin12	0 ~ +10V

Table 8 P10 POS VR

P10	Pos VR Fully CW ~ Fully CCW
Pin15	−10V ~ +10V
Pin16	−10V ~ +10V
Pin13	−10V ~ +10V
Pin14	−10V ~ +10V

TROUBLESHOOTING


CH2 VERTICAL
(CH2 SELECT)
P10 Pin3,5,6 Voltage, normal
Table 5
YES
NO
POWER
(POWER VOLTAGE)
Q201 Emitter Waveform, normal
Fig. 11
Q201
R239,240 Rear Pin Waveform normal
Fig. 12
U3, Pin 4 Voltage, normal
Table 6
Q202,203, 204,205, 206,207
P10 Pin7,9,10 Signal, normal
Fig. 2
U3
R/O
Q222,223 Base Signal, normal
Fig. 13
U3, Pin2,3 Voltage, normal
Table 6
Q210,211 K201,202
P10, Pin7,9,10 Signal, normal
Fig. 2
U3
R/O
Q217,218 Collector Signal, normal
Fig. 14
Variable operation normal
Q212,213, 214,215, 216, 217, 218 U201a
P10, Pin12 Voltage, normal
U201b, D203,204
PANEL
Q505,506, Emitter Signal, normal
Fig. 15
Q219,220, Q505,506
Vertical Position Operation normal
P10, Pin16 Voltage, normal
Table 8
Q507,508
PANEL
1


1
U9 Pin3,11,8 U7, Pin8 Signal, normal
Fig. 3
YES
NO
P10 Pin8 Waveform, normal
Fig. 3
V-CLK
U1 Pin4,5,6,7 Voltage, normal
Table 2
U4,5,6,7,8, 9
P15 Pin 7,9,10 Waveform, normal
Fig. 2
U1
R/O
Q528,529 Collector Waveform, normal
(only CH2 SELECT)
Q3,4,528, 529 D501,502, 503,504, 505,506, 507,508, 509
END

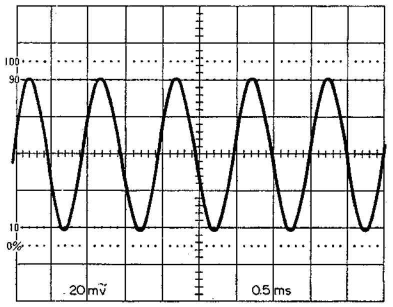


Fig. 11 DC +6V

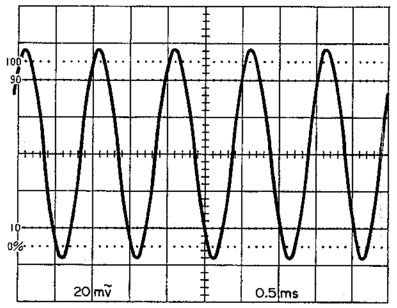


Fig. 12 DC −1.8V

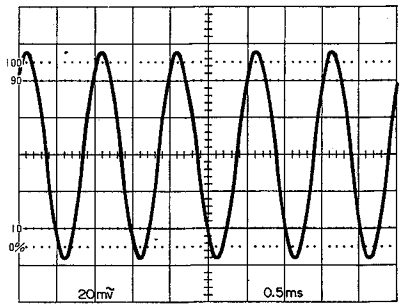


Fig. 13 DC −1.8V

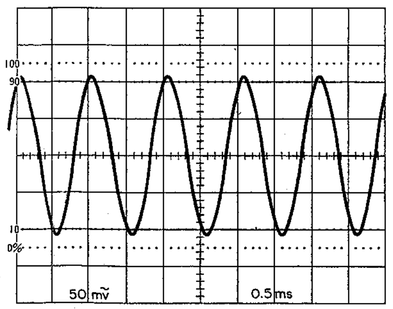


Fig. 14 DC +4.8V

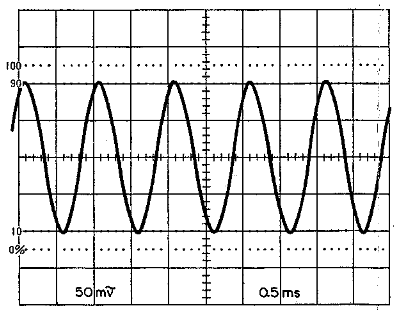
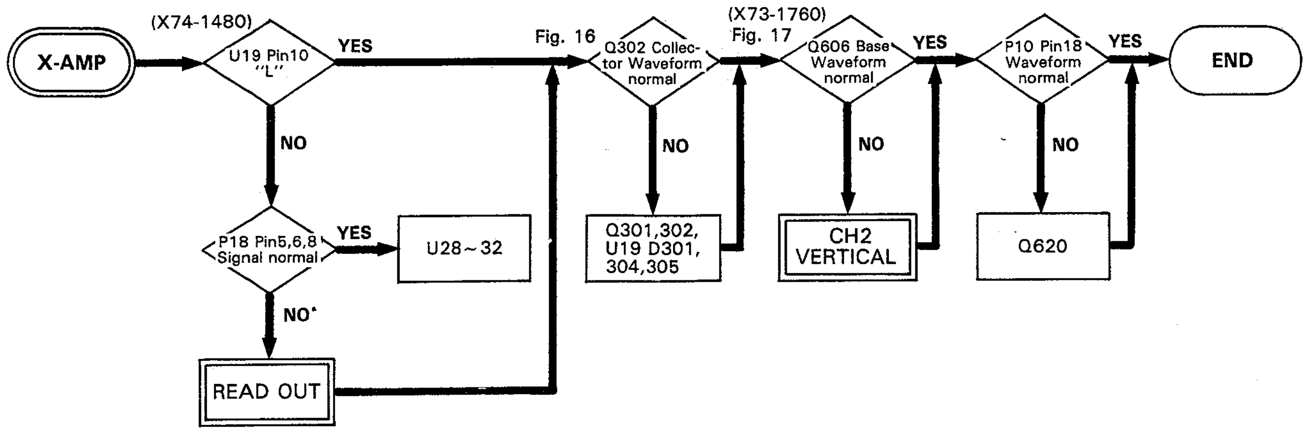


Fig. 15 DC +4.8V

TROUBLESHOOTING


X-AMP
(X74-1480)
U19 Pin10 "L"
YES
NO
P18 Pin5,6,8 Signal normal
YES
U28~32
NO*
READ OUT
Fig. 16
Q302 Collector Waveform normal
NO
Q301,302, U19 D301, 304,305
(X73-1760)
Fig. 17
Q606 Base Waveform normal
YES
NO
CH2 VERTICAL
P10 Pin18 Waveform normal
YES
NO
Q620
YES
END

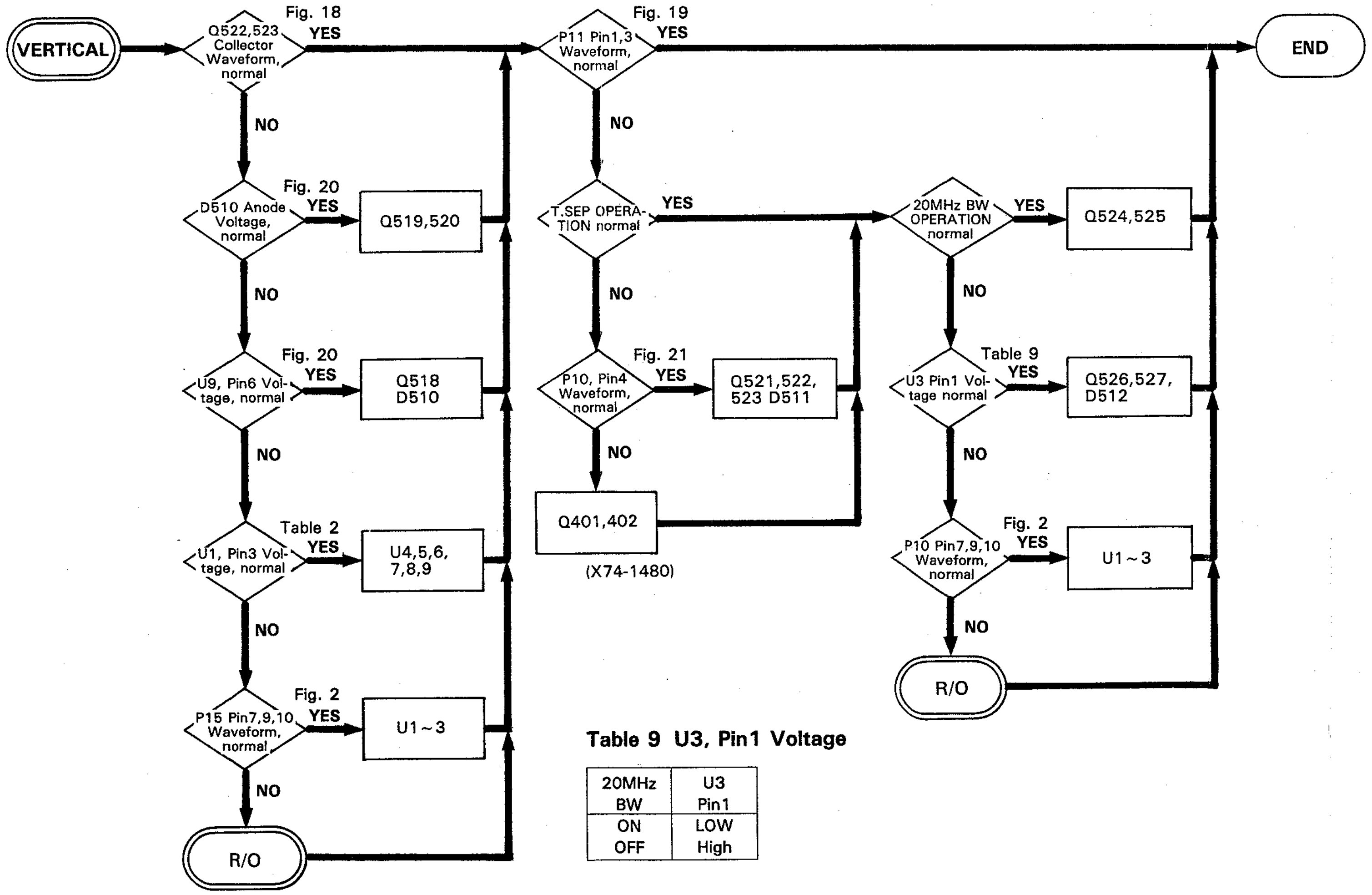

VERTICAL
Fig. 18
Q522,523 Collector Waveform, normal
YES
NO
Fig. 20
D510 Anode Voltage, normal
YES
Q519,520
NO
Fig. 20
U9, Pin6 Voltage, normal
YES
Q518 D510
NO
Table 2
U1, Pin3 Voltage, normal
YES
U4,5,6, 7,8,9
NO
Fig. 2
P15 Pin7,9,10 Waveform, normal
YES
U1~3
NO
R/O
Fig. 19
P11 Pin1,3 Waveform, normal
YES
NO
T.SEP OPERATION normal
YES
NO
Fig. 21
P10, Pin4 Waveform, normal
YES
Q521,522, 523 D511
NO
Q401,402
(X74-1480)
20MHz BW OPERATION normal
YES
Q524,525
NO
Table 9
U3 Pin1 Voltage normal
YES
Q526,527, D512
NO
Fig. 2
P10 Pin7,9,10 Waveform, normal
YES
U1~3
NO
R/O
END

Table 9 U3, Pin1 Voltage

20MHz BW	U3 Pin1
ON	LOW
OFF	High

H-MODE "X-Y"
Input: 40mVp-p 1kHz
Sine Wave
Volts/div: 5mV/div

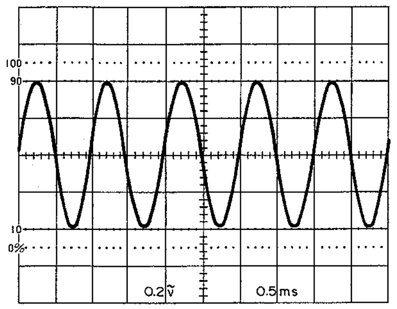


Fig. 16 DC +2.4V

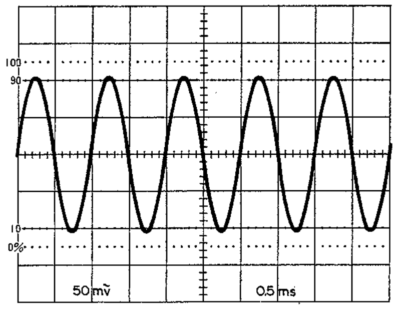


Fig. 17 DC +5V

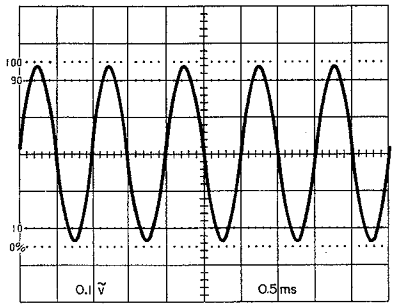


Fig. 18 DC −5.0V

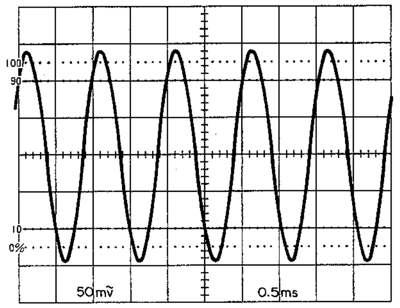
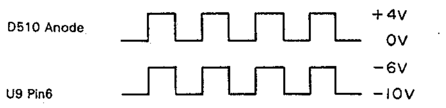
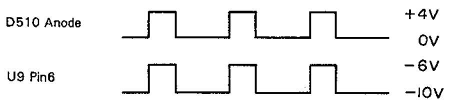


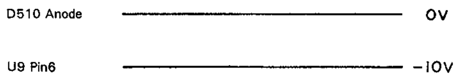
Fig. 19 DC +5V



(a) V-MODE "ADD" + The other one

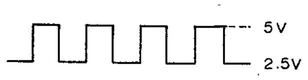


(b) V-MODE "ADD" + CH × 2

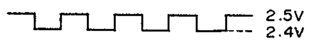


(c) V-MODE "ADD" is not selected

Fig. 20 D510 Anode, U9, Pin6 Waveform



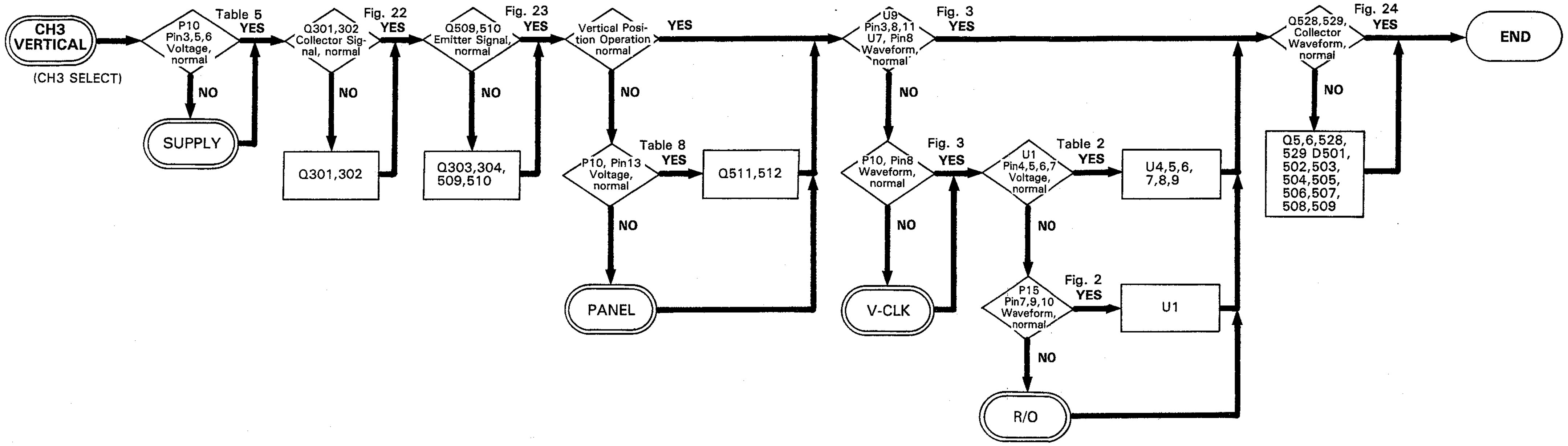
(a) T. SEP FULLY CCW

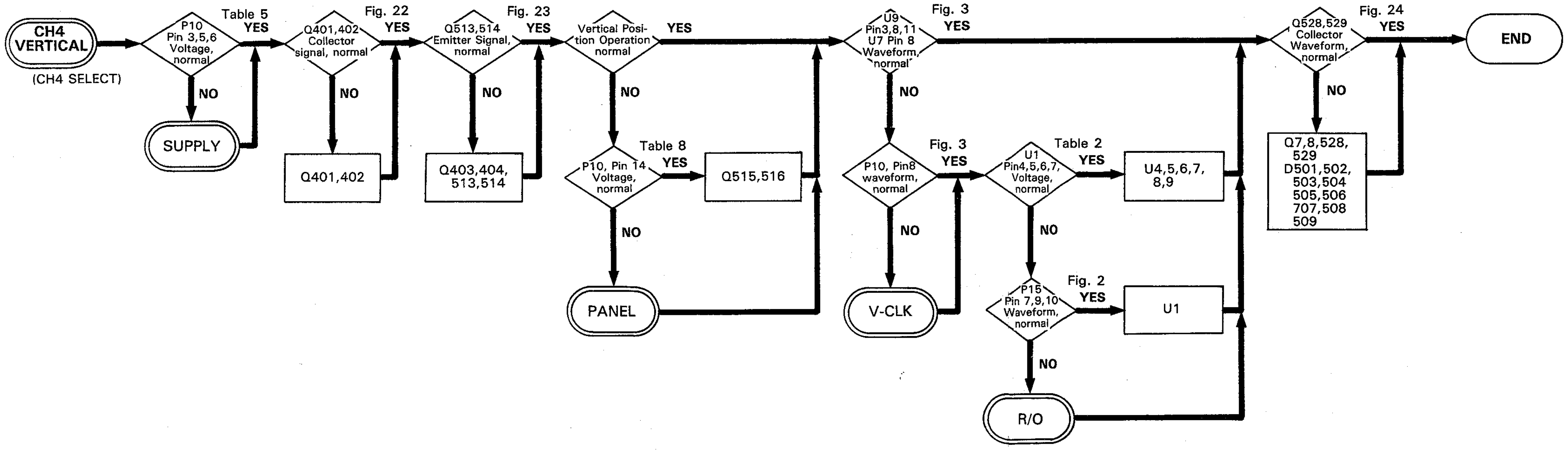


(b) T. SEP FULLY CW

Fig. 21 T. SEP. P10 Pin4 Waveform
H-MODE "ALT"

TROUBLESHOOTING


CH3 VERTICAL
(CH3 SELECT)
P10 Pin3,5,6 Voltage, normal
Table 5
YES
NO
SUPPLY
Q301,302 Collector Signal, normal
Fig. 22
YES
NO
Q301,302
Q509,510 Emitter Signal, normal
Fig. 23
YES
NO
Q303,304, 509,510
Vertical Position Operation normal
YES
NO
P10, Pin13 Voltage, normal
Table 8
YES
Q511,512
NO
PANEL
U9 Pin3,8,11 U7, Pin8 Waveform, normal
Fig. 3
YES
NO
P10, Pin8 Waveform, normal
Fig. 3
YES
NO
V-CLK
U1 Pin4,5,6,7 Voltage, normal
Table 2
YES
U4,5,6, 7,8,9
NO
P15 Pin7,9,10 Waveform, normal
Fig. 2
YES
U1
NO
R/O
Q528,529, Collector Waveform, normal
Fig. 24
YES
END
NO
Q5,6,528, 529 D501, 502,503, 504,505, 506,507, 508,509


CH4 VERTICAL
(CH4 SELECT)
P10 Pin 3,5,6 Voltage, normal
Table 5
YES
NO
SUPPLY
Q401,402 Collector signal, normal
Fig. 22
YES
NO
Q401,402
Q513,514 Emitter Signal, normal
Fig. 23
YES
NO
Q403,404, 513,514
Vertical Position Operation normal
YES
NO
P10, Pin 14 Voltage, normal
Table 8
YES
Q515,516
NO
PANEL
U9 Pin3,8,11 U7 Pin 8 Waveform, normal
Fig. 3
YES
NO
P10, Pin8 waveform, normal
Fig. 3
YES
NO
V-CLK
U1 Pin4,5,6,7, Voltage, normal
Table 2
YES
U4,5,6,7, 8,9
NO
P15 Pin 7,9,10 Waveform, normal
Fig. 2
YES
U1
NO
R/O
Q528,529 Collector Waveform, normal
Fig. 24
YES
END
NO
Q7,8,528, 529 D501,502, 503,504 505,506 707,508 509

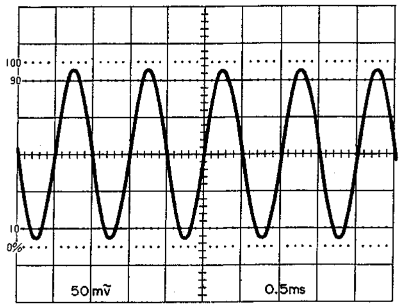


Fig. 22 DC −5.0V

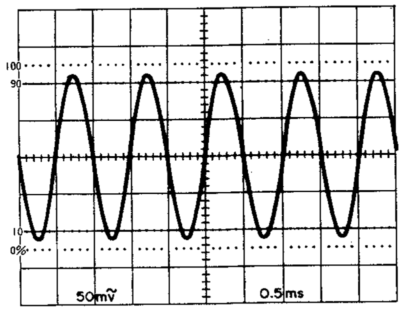


Fig. 23 DC +5.0V

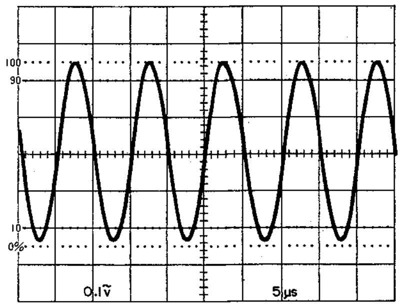
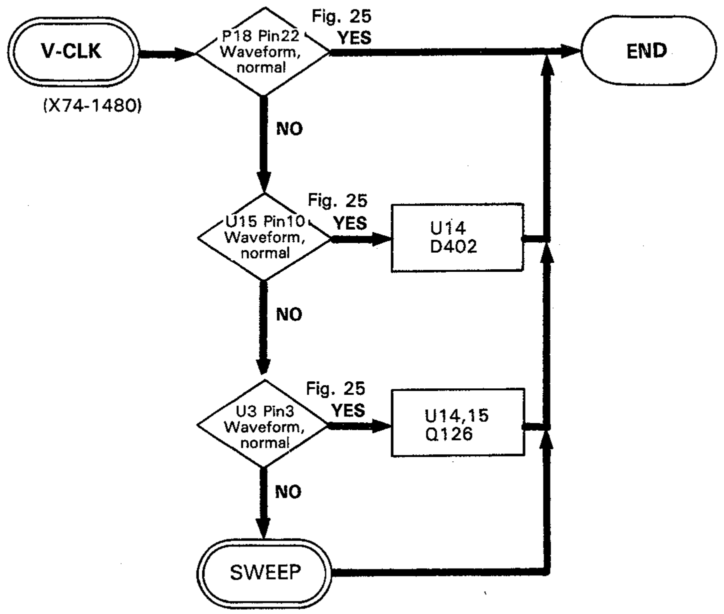
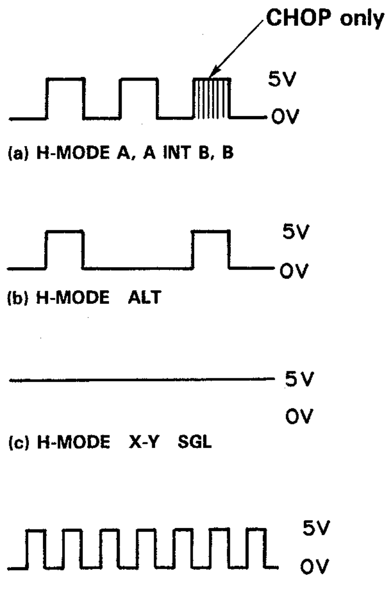


Fig. 24 DC −5.0V
Input 0.8Vp-p Sine Wave

TROUBLESHOOTING


V-CLK
(X74-1480)
P18 Pin22 Waveform, normal
Fig. 25
YES
END
NO
U15 Pin10 Waveform, normal
Fig. 25
YES
U14
D402
NO
U3 Pin3 Waveform, normal
Fig. 25
YES
U14,15
Q126
NO
SWEEP


CHOP only
5V
0V
5V
0V
5V
0V
5V
0V

(a) H-MODE A, A INT B, B

(b) H-MODE ALT

(c) H-MODE X-Y SGL

(d) H-MODE X-Y ALT

Fig. 25 Waveform

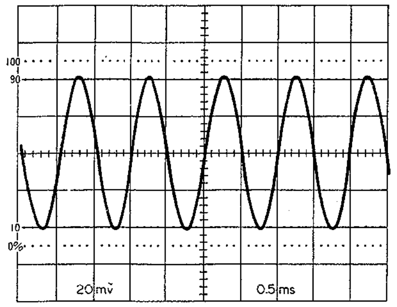


Fig. 26 DC +5V

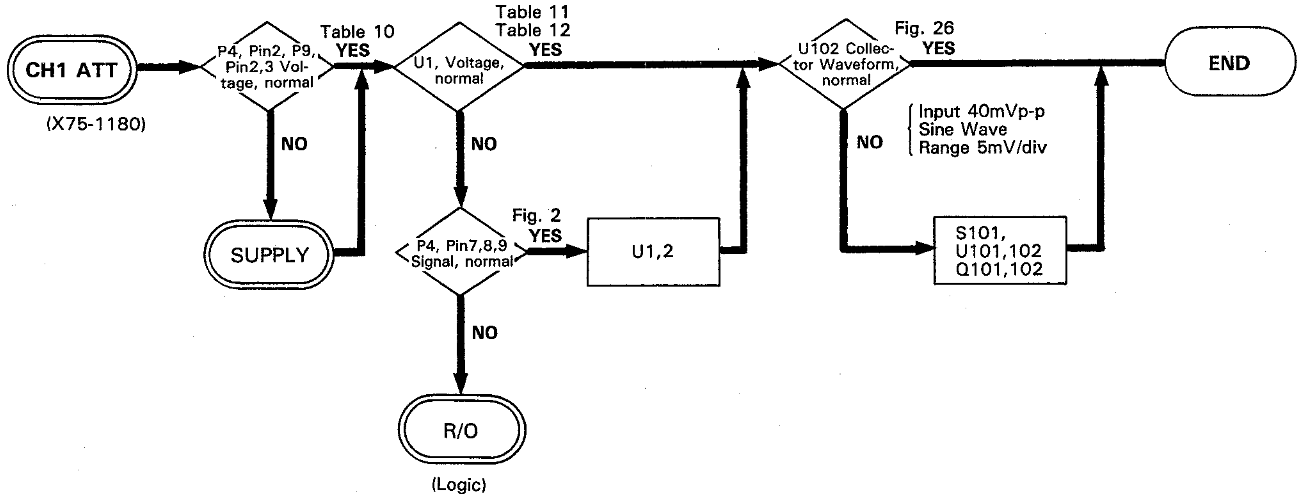

CH1 ATT
(X75-1180)
P4, Pin2, P9, Pin2,3 Voltage, normal
Table 10
YES
NO
SUPPLY
U1, Voltage, normal
Table 11
Table 12
YES
NO
P4, Pin7,8,9 Signal, normal
Fig. 2
YES
U1,2
NO
R/O
(Logic)
U102 Collector Waveform, normal
Fig. 26
YES
NO
Input 40mVp-p
Sine Wave
Range 5mV/div
S101,
U101,102
Q101,102
END

Table 10 INPUT Voltage

Ref. No.	Pin No.	Voltage [V]
P4	2	+5
P9	2	−10
P9	3	+10

Table 11

Volts/div	X75-1180		X73-1760			
	1/10 ATT	1/100 ATT	×5 Amp	×1 Amp	1/2 ATT	1/4 ATT
1mV			○			
2			○		○	
5				○		
10				○	○	
20				○	○	○
50	○			○		
0.1V	○			○	○	
0.2	○			○	○	○
0.5		○		○		
1.0		○		○	○	
2.0		○		○	○	○
5.0	○	○		○		

Table 12 U1, U2 FUNCTION

Pin No.	U1	U2
1	CH2 GND	
2	CH2 1/10	CH3 1/5
3	CH2 1/100	CH4 1/5
4	CH1 AC/DC	CH2 INV
5	CH1 GND	
6	CH1 1/10	
7	CH1 1/100	
15	CH2 AC/DC	

TROUBLESHOOTING

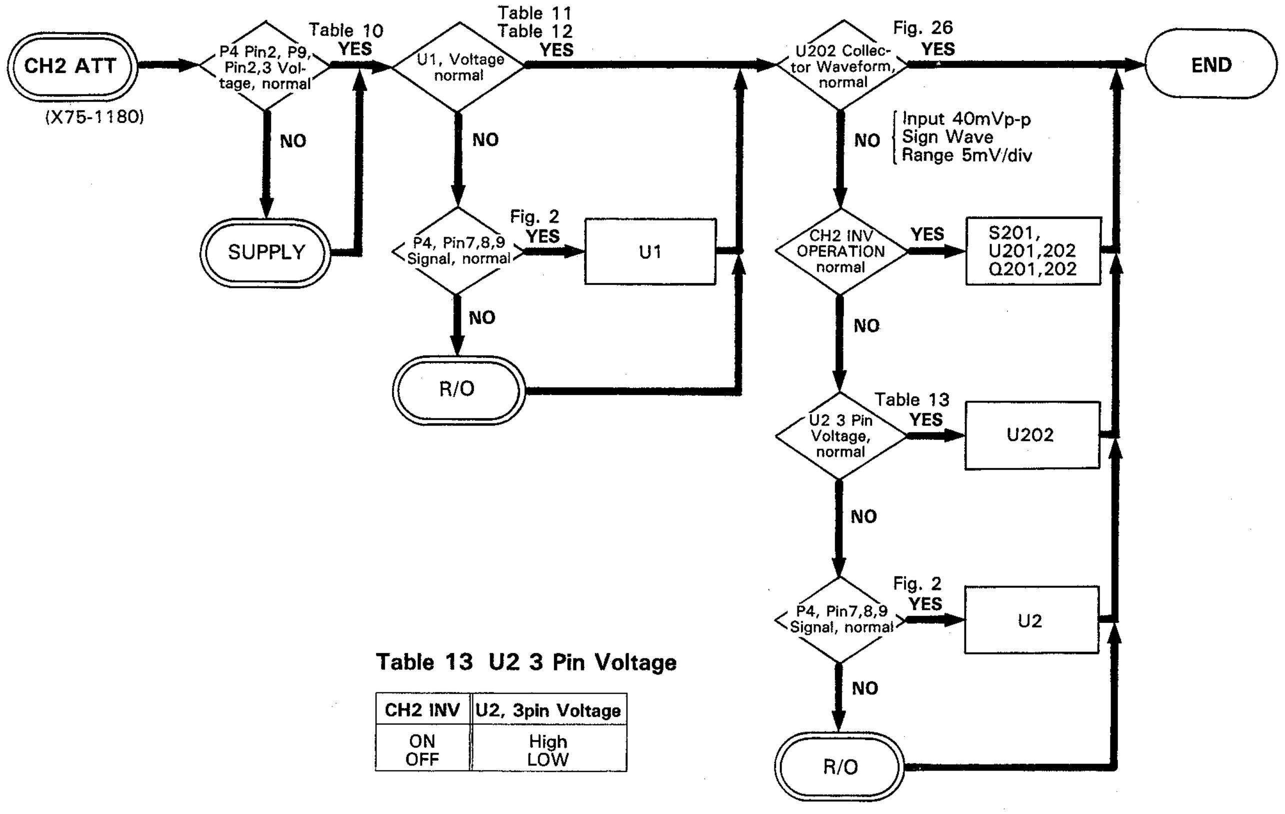

CH2 ATT
(X75-1180)
P4 Pin2, P9, Pin2,3 Voltage, normal
Table 10
YES
NO
SUPPLY
U1, Voltage normal
Table 11
Table 12
YES
NO
P4, Pin7,8,9 Signal, normal
Fig. 2
YES
U1
NO
R/O
U202 Collector Waveform, normal
Fig. 26
YES
END
NO
Input 40mVp-p
Sign Wave
Range 5mV/div
CH2 INV OPERATION normal
YES
S201, U201,202 Q201,202
NO
U2 3 Pin Voltage, normal
Table 13
YES
U202
NO
P4, Pin7,8,9 Signal, normal
Fig. 2
YES
U2
NO
R/O

Table 13 U2 3 Pin Voltage

CH2 INV	U2, 3pin Voltage
ON	High
OFF	LOW

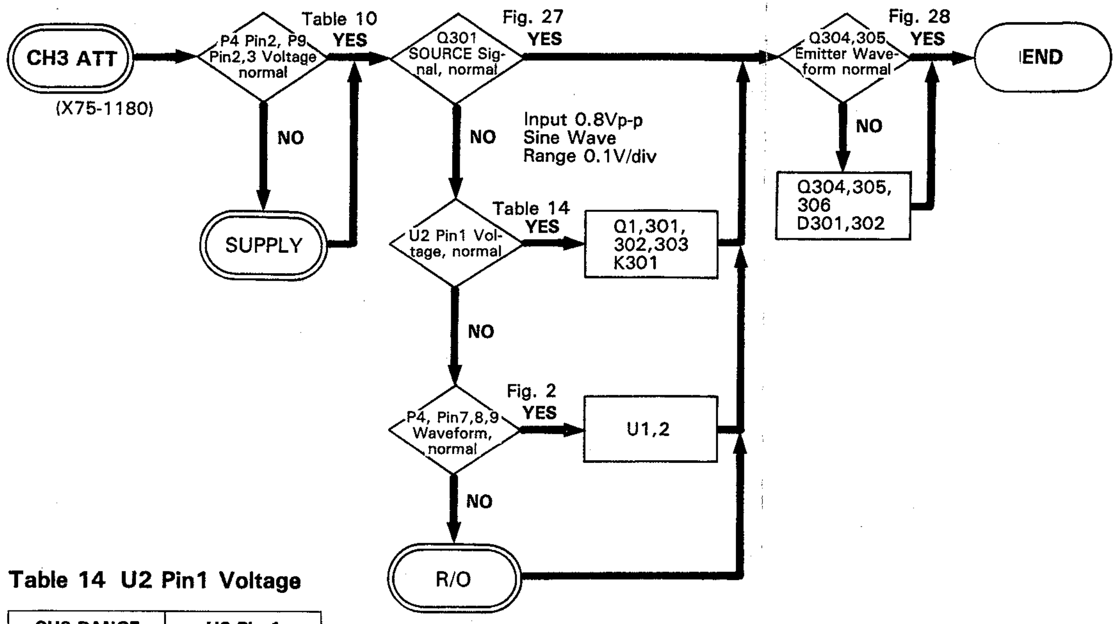

CH3 ATT
(X75-1180)
P4 Pin2, P9, Pin2,3 Voltage normal
Table 10
YES
NO
SUPPLY
Q301 SOURCE Signal, normal
Fig. 27
YES
NO
Input 0.8Vp-p
Sine Wave
Range 0.1V/div
U2 Pin1 Voltage, normal
Table 14
YES
Q1,301, 302,303 K301
NO
P4, Pin7,8,9 Waveform, normal
Fig. 2
YES
U1,2
NO
R/O
Q304,305, Emitter Waveform normal
Fig. 28
YES
END
NO
Q304,305, 306 D301,302

Table 14 U2 Pin1 Voltage

CH3 RANGE	U2 Pin 1
0.5 V/div	High
0.1 V/div	LOW

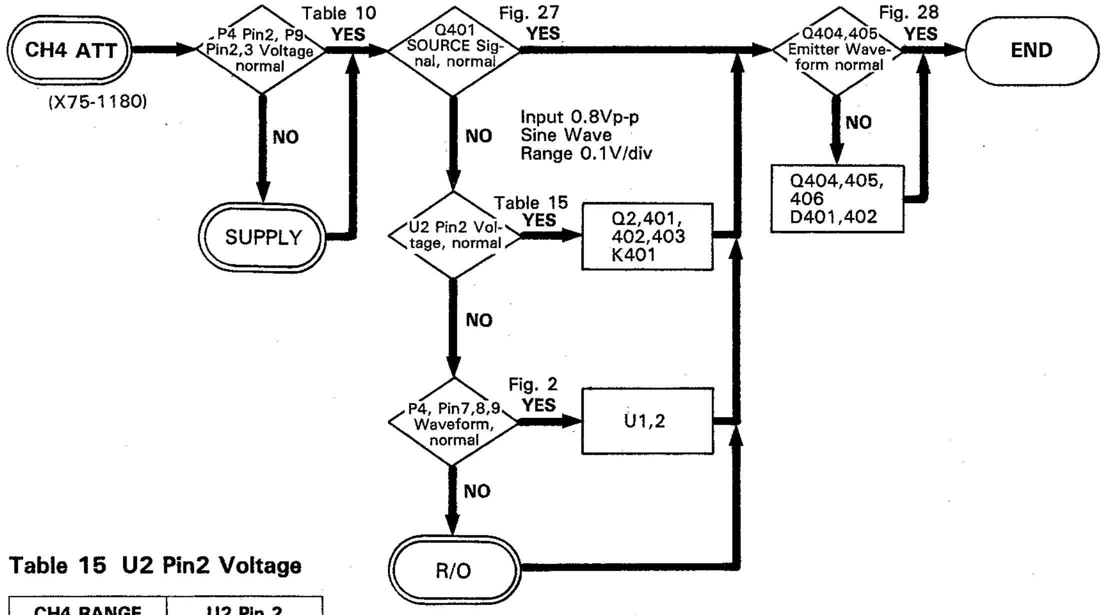

CH4 ATT
(X75-1180)
P4 Pin2, P9, Pin2,3 Voltage normal
Table 10
YES
NO
SUPPLY
Q401 SOURCE Signal, normal
Fig. 27
YES
NO
Input 0.8Vp-p
Sine Wave
Range 0.1V/div
U2 Pin2 Voltage, normal
Table 15
YES
Q2,401, 402,403 K401
NO
P4, Pin7,8,9 Waveform, normal
Fig. 2
YES
U1,2
NO
R/O
Q404,405, Emitter Waveform normal
Fig. 28
YES
END
NO
Q404,405, 406 D401,402

Table 15 U2 Pin2 Voltage

CH4 RANGE	U2 Pin 2
0.5 V/div	High
0.1 V/div	LOW

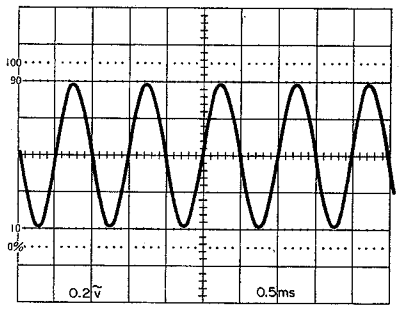


Fig. 27 DC −0.27 V

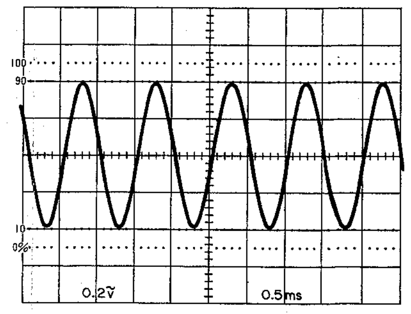


Fig. 28 DC −1.0 V

TROUBLESHOOTING

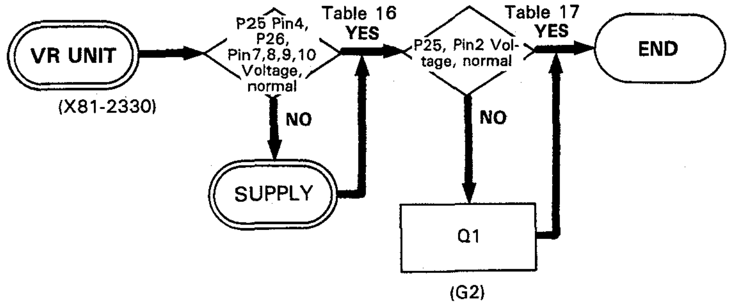

VR UNIT
(X81-2330)
P25 Pin4, P26, Pin7,8,9,10 Voltage, normal
Table 16
YES
NO
SUPPLY
P25, Pin2 Voltage, normal
Table 17
YES
NO
Q1
(G2)
END

Table 16 Voltage

P25 Pin No.	Voltage [V]
4	+140
P26 Pin No.	**Voltage [V]**
7	+10
8	−10
9	+13
10	−13

Table 17 Voltage

P25	Voltage [V]
Pin 2	+20

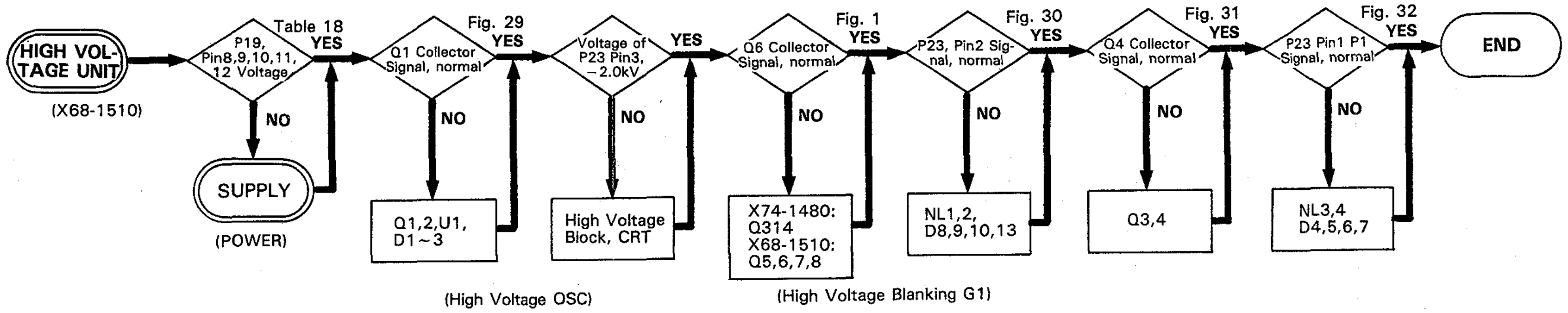

HIGH VOLTAGE UNIT
(X68-1510)
P19, Pin8,9,10,11, 12 Voltage
Table 18
YES
NO
SUPPLY
(POWER)
Q1 Collector Signal, normal
Fig. 29
YES
NO
Q1,2,U1, D1~3
Voltage of P23 Pin3, −2.0kV
YES
NO
High Voltage Block, CRT
(High Voltage OSC)
Q6 Collector Signal, normal
Fig. 1
YES
NO
X74-1480: Q314 X68-1510: Q5,6,7,8
P23, Pin2 Signal, normal
Fig. 30
YES
NO
NL1,2, D8,9,10,13
(High Voltage Blanking G1)
Q4 Collector Signal, normal
Fig. 31
YES
NO
Q3,4
P23 Pin1 P1 Signal, normal
Fig. 32
YES
NO
NL3,4 D4,5,6,7
END

Table 18

P19 Pin No.	Voltage [V]
8	+10
9	−10
10	+13
11	−13
12	+140

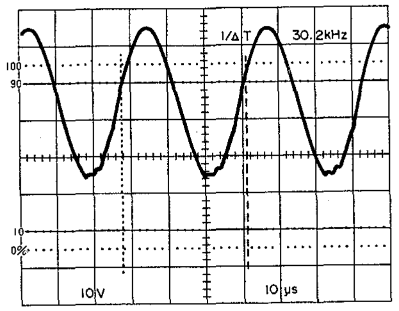


Fig. 29 Q1, Collector Waveform

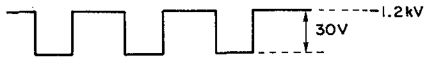


Fig. 30 G1, P23, Pin2

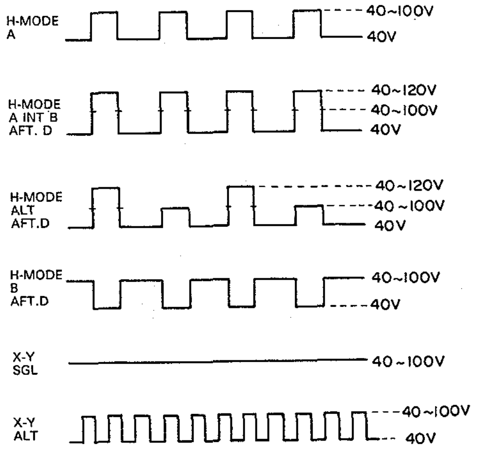

H-MODE A
40~100V
40V
H-MODE A INT B AFT. D
40~120V
40~100V
40V
H-MODE ALT AFT.D
40~120V
40~100V
40V
H-MODE B AFT.D
40~100V
40V
X-Y SGL
40~100V
X-Y ALT
40~100V
40V

Fig. 31 Q4, Collector Signal

A SWEEP TIME = B SWEEP TIME
DELAY TIME MIN

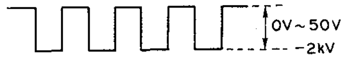


Fig. 32 P1, P23, Pin1 Signal

TROUBLESHOOTING

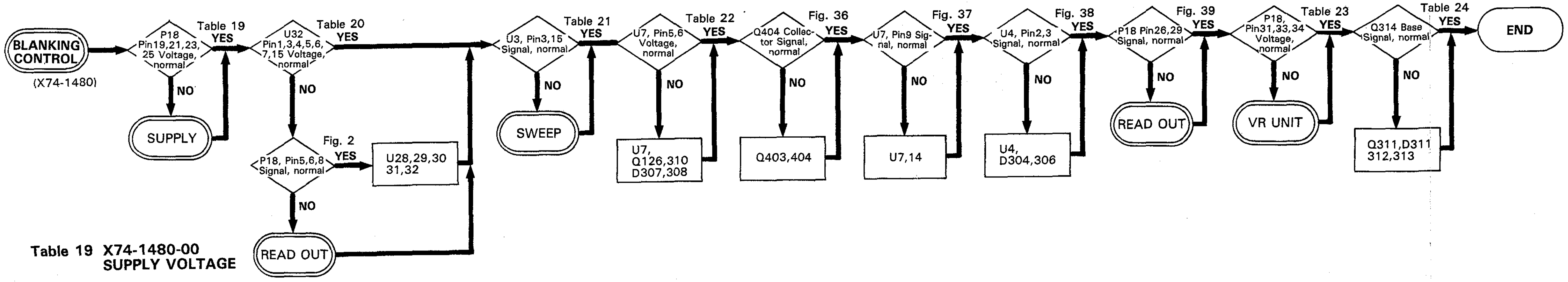

BLANKING CONTROL
(X74-1480)
P18 Pin19,21,23, 25 Voltage, normal
Table 19
YES
NO
SUPPLY
U32 Pin1,3,4,5,6, 7,15 Voltage, normal
Table 20
YES
NO
P18, Pin5,6,8 Signal, normal
Fig. 2
YES
NO
U28,29,30 31,32
READ OUT
U3, Pin3,15 Signal, normal
Table 21
YES
NO
SWEEP
U7, Pin5,6 Voltage, normal
Table 22
YES
NO
U7, Q126,310 D307,308
Q404 Collector Signal, normal
Fig. 36
YES
NO
Q403,404
U7, Pin9 Signal, normal
Fig. 37
YES
NO
U7,14
U4, Pin2,3 Signal, normal
Fig. 38
YES
NO
U4, D304,306
P18 Pin26,29 Signal, normal
Fig. 39
YES
NO
READ OUT
P18, Pin31,33,34 Voltage, normal
Table 23
YES
NO
VR UNIT
Q314 Base Signal, normal
Table 24
YES
NO
Q311,D311 312,313
END

Table 19 X74-1480-00 SUPPLY VOLTAGE

P18	Voltage [V]
Pin 19	+ 5
Pin 21	+ 5
Pin 23	+10
Pin 25	−10

Table 20 U32 Pin VOLTAGE

HORIZ DISPLAY MODE		ALT Pin1	B Pin3	XY SGL Pin4	ATT. D Pin5	A Pin6	CHOP Pin15
A		H	H	L	H	L	V-MODE ALT "H"
A INT B	NORM	H	H	L	H	H	
	AFT. D	H	H	L	L	H	
ALT	NORM	L	H	L	H	H	V-MODE CHOP "L"
	AFT. D	L	H	L	L	H	
B	NORM	H	L	L	H	H	
	AFT. D	H	L	L	L	H	
X-Y	SINGLE	H	H	H	H	H	
	ALT	H	H	L	H	H	

Table 21 U3 Pin3, 15

HORIZ DISPLAY MODE		AS Pin3	BS Pin15
A		Fig. 33	H
A INT B	NORM	Fig. 33	H
	AFT. D	Fig. 34	←
ALT	NORM	Fig. 33	H
	AFT. D	Fig. 34	←
B	NORM	Fig. 33	H
	AFT. D	Fig. 34	←
X-Y	SGL	H	H

Table 22 A $\overline{\text{STATE}}$, B $\overline{\text{STATE}}$

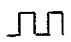
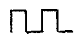
HORIZ DISPLAY MODE	B $\overline{\text{STATE}}$ U7 Pin 5	A $\overline{\text{STATE}}$ U7 Pin6
A	H	L
A INT B	H	L
ALT		
B	L	H
X-Y	H	L

Table 23 A,B, R/O INTEN Voltage

	FULLY CW INTEN MAX ~ FULLY CCW INTEN MIN
A INTEN P18 Pin33	−10V ~ +10V
B INTEN P28 Pin34	−10V ~ +10V
R/O INTEN P18 Pin31	−10V ~ +10V

Table 24 Q314 Base Signal

HORIZ DISPLAY MODE	Q314 Base Signal
A	Fig. 35
A INT B AFT. D	Fig. 35
ALT AFT.D	Fig. 35
B AFT.D	Fig. 35
X-Y	0.5 ~ 1.8V

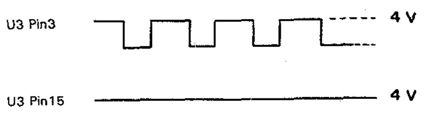

U3 Pin3
4 V
U3 Pin15
4 V

Fig. 33 HORIZ MODE "A"

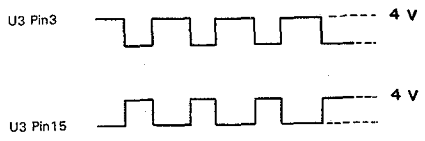

U3 Pin3
4 V
U3 Pin15
4 V

Fig. 34 HORIZ MODE "A INT B" "ALT"
AFT D, Delay time Min
B SWEEP TIME = A SWEEP TIME

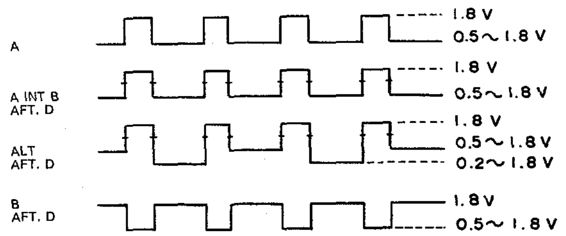

A
1.8 V
0.5～1.8 V
A INT B AFT. D
1.8 V
0.5～1.8 V
ALT AFT. D
1.8 V
0.5～1.8 V
0.2～1.8 V
B AFT. D
1.8 V
0.5～1.8 V

Fig. 35 Q314 Base Signal

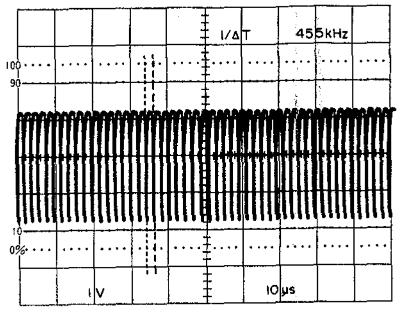
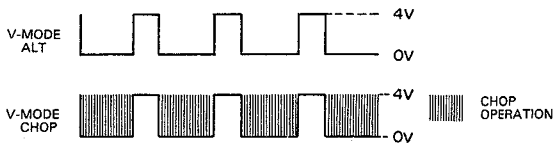
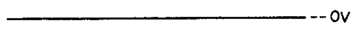


Fig. 36 Q404 Collector Signal

TROUBLESHOOTING

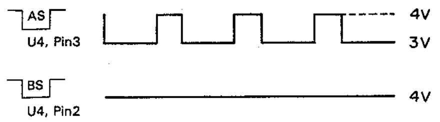

V-MODE ALT
4V
0V
V-MODE CHOP
4V
0V
CHOP OPERATION

(a) H-MODE "ALT"

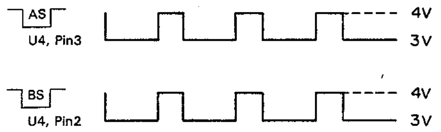


(b) H-MODE THE OTHER

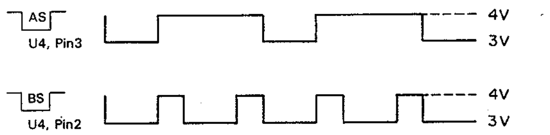
Fig. 37 U7, Pin9 Signal


AS
U4, Pin3
4V
3V
BS
U4, Pin2
4V

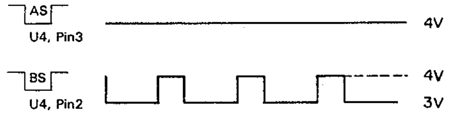
(a) H-MODE "A"


AS
U4, Pin3
4V
3V
BS
U4, Pin2
4V
3V

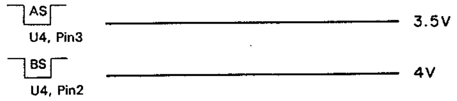
(b) H-MODE "A INT B"
A SWEEP TIME = B SWEEP TIME
DELAY TIME MIN


AS
U4, Pin3
4V
3V
BS
U4, Pin2
4V
3V

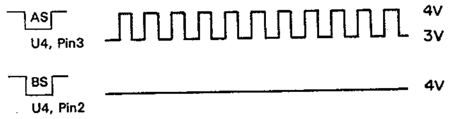
(c) H-MODE "ALT"
A SWEEP TIME = B SWEEP TIME
DELAY TIME MIN


AS
U4, Pin3
4V
BS
U4, Pin2
4V
3V

(d) H-MODE "D"
A SWEEP TIME = B SWEEP TIME
DELAY TIME MIN


AS
U4, Pin3
3.5V
BS
U4, Pin2
4V

(e) H-MODE "X-Y" SGL


AS
U4, Pin3
4V
3V
BS
U4, Pin2
4V

(f) H-MODE "X-Y" ALT

Fig. 38 U4, Pin2,3 Signal

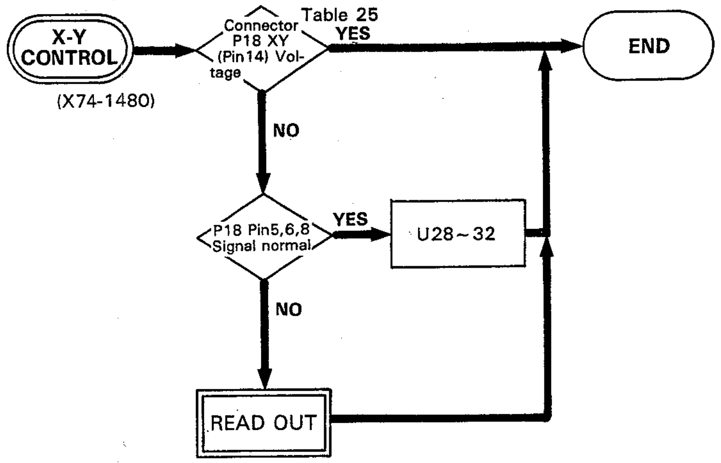
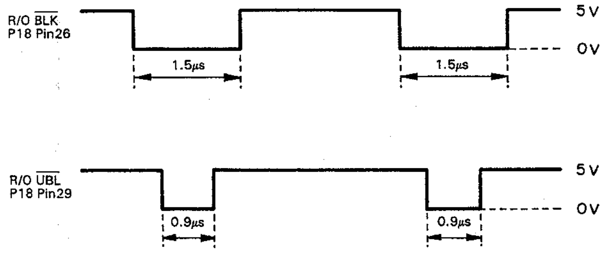
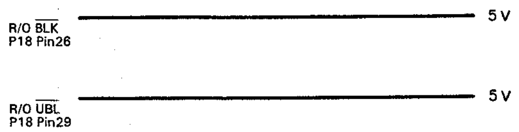

X-Y CONTROL
(X74-1480)
Connector P18 XY (Pin14) Voltage
Table 25
YES
END
NO
P18 Pin5,6,8 Signal normal
YES
U28~32
NO
READ OUT

Table 25 X-Y Signal

X-Y	P18 Pin14 X-Y
ON	L
OFF	H


R/O BLK
P18 Pin26
5V
0V
1.5μs
1.5μs
R/O UBL
P18 Pin29
5V
0V
0.9μs
0.9μs

(a) R/O ON


R/O BLK
P18 Pin26
5V
R/O UBL
P18 Pin29
5V

(b) R/O OFF

Fig. 39 P18 Pin26, 29, R/O $\overline{\text{BLK}}$, R/O $\overline{\text{UBL}}$ Signal

TROUBLESHOOTING

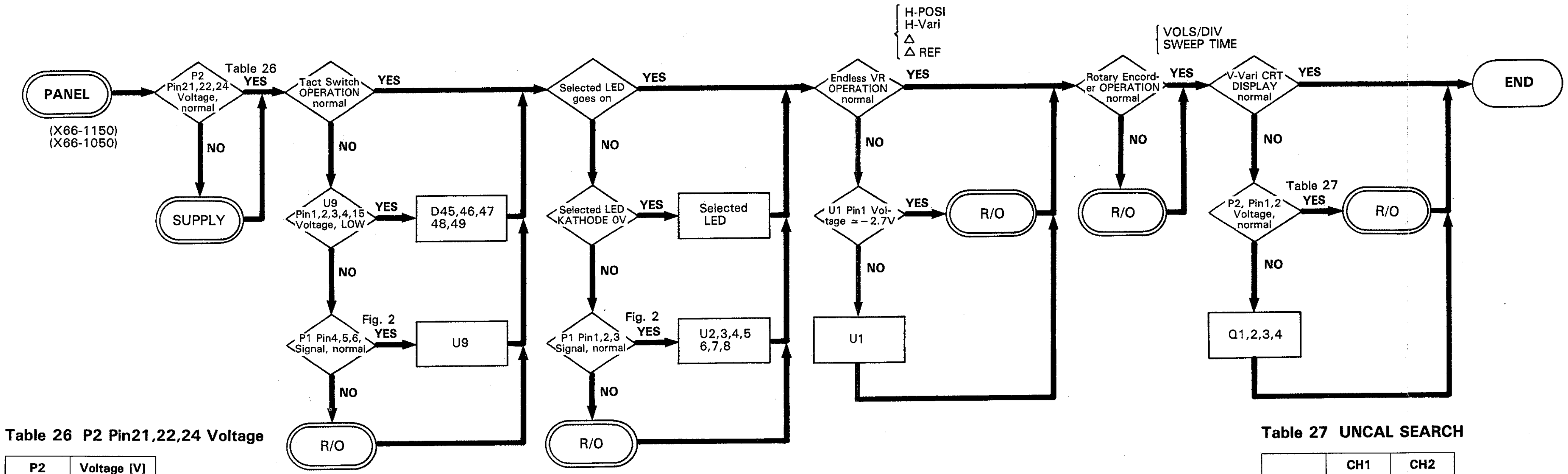

PANEL
(X66-1150)
(X66-1050)
P2 Pin21,22,24 Voltage, normal
Table 26
YES
NO
SUPPLY
Tact Switch OPERATION normal
YES
NO
U9 Pin1,2,3,4,15 Voltage, LOW
YES
D45,46,47 48,49
NO
P1 Pin4,5,6, Signal, normal
Fig. 2
YES
U9
NO
R/O
Selected LED goes on
YES
NO
Selected LED KATHODE 0V
YES
Selected LED
NO
P1 Pin1,2,3 Signal, normal
Fig. 2
YES
U2,3,4,5 6,7,8
NO
R/O
H-POSI
H-Vari
Δ
Δ REF
Endless VR OPERATION normal
YES
NO
U1 Pin1 Voltage ≃ −2.7V
YES
R/O
NO
U1
VOLS/DIV
SWEEP TIME
Rotary Encoder OPERATION normal
YES
NO
R/O
V-Vari CRT DISPLAY normal
YES
NO
P2, Pin1,2 Voltage, normal
Table 27
YES
R/O
NO
Q1,2,3,4
END

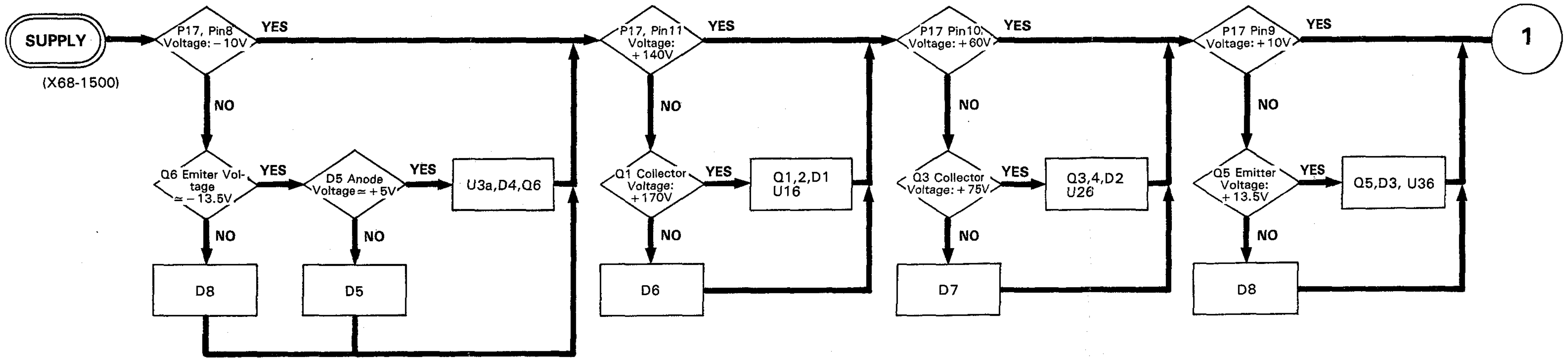
Table 26 P2 Pin21,22,24 Voltage

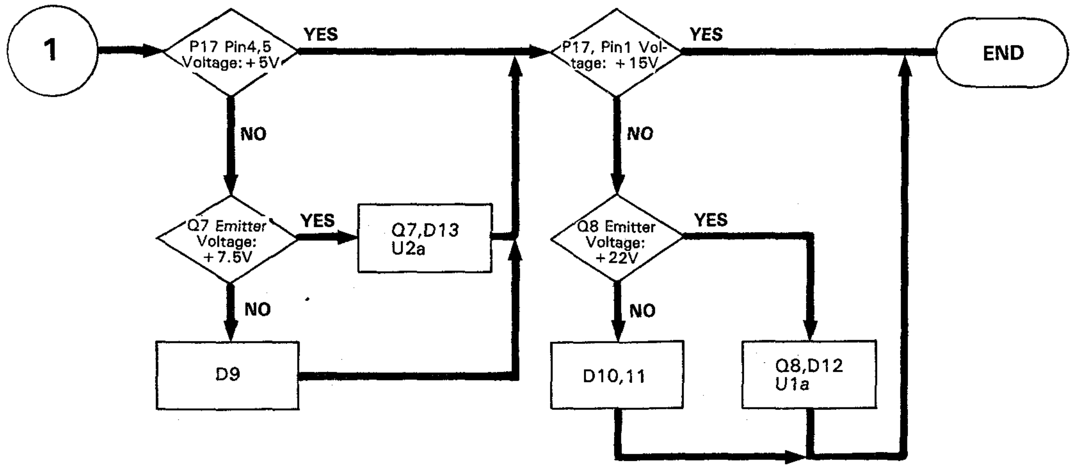
P2	Voltage [V]
Pin 21	+10
22	−10
24	+5

Table 27 UNCAL SEARCH

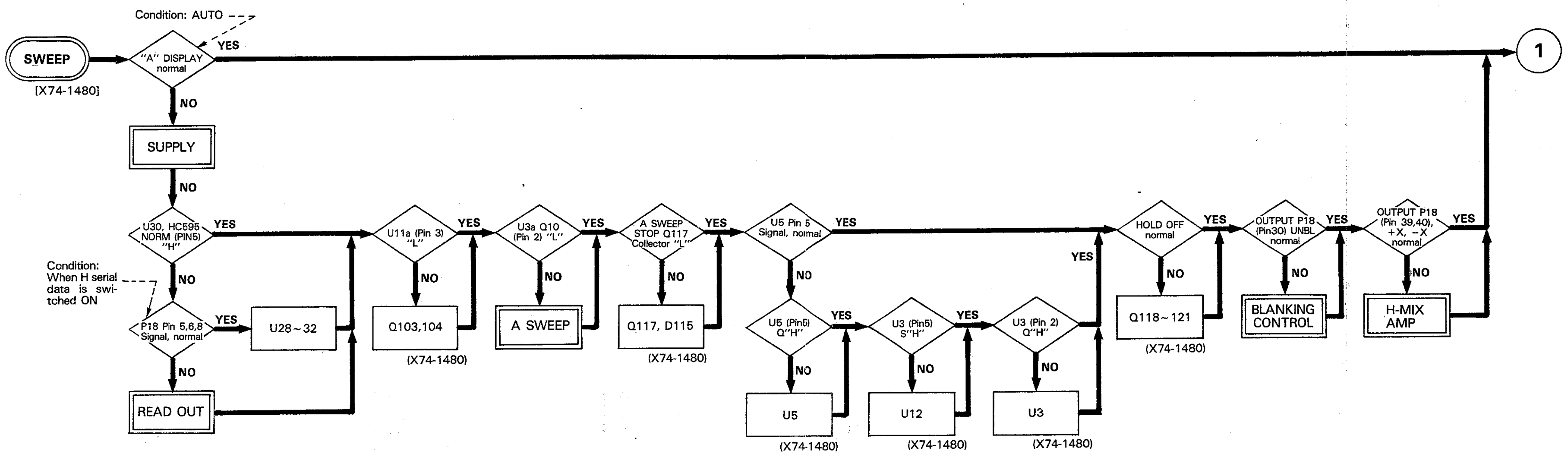
	CH1 P2, Pin1	CH2 P2, Pin2
CAL	+0.12 [V]	+0.12 [V]
UNCAL	+4.85 [V]	+4.85 [V]

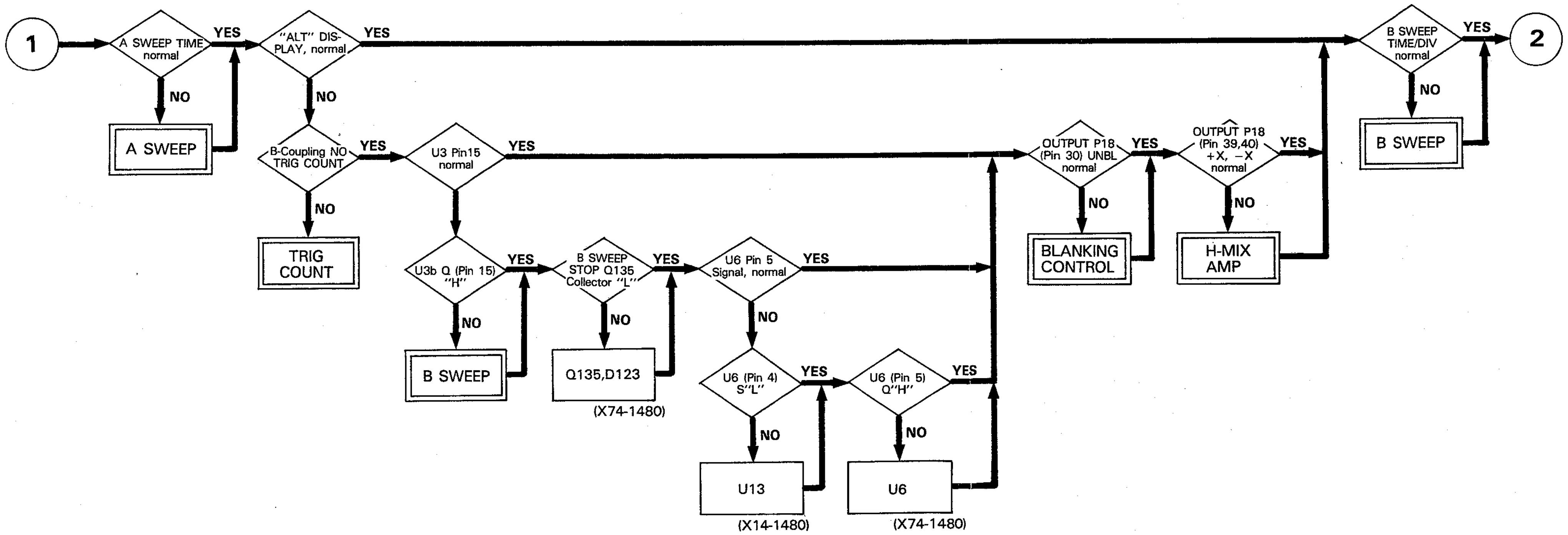
TROUBLESHOOTING


SUPPLY
(X68-1500)
P17, Pin8 Voltage: −10V
YES
NO
Q6 Emiter Voltage ≃ −13.5V
YES
NO
D5 Anode Voltage ≃ +5V
YES
NO
U3a,D4,Q6
D8
D5
P17, Pin11 Voltage: +140V
YES
NO
Q1 Collector Voltage: +170V
YES
NO
Q1,2,D1 U16
D6
P17 Pin10 Voltage: +60V
YES
NO
Q3 Collector Voltage: +75V
YES
NO
Q3,4,D2 U26
D7
P17 Pin9 Voltage: +10V
YES
NO
Q5 Emitter Voltage: +13.5V
YES
NO
Q5,D3, U36
D8
1

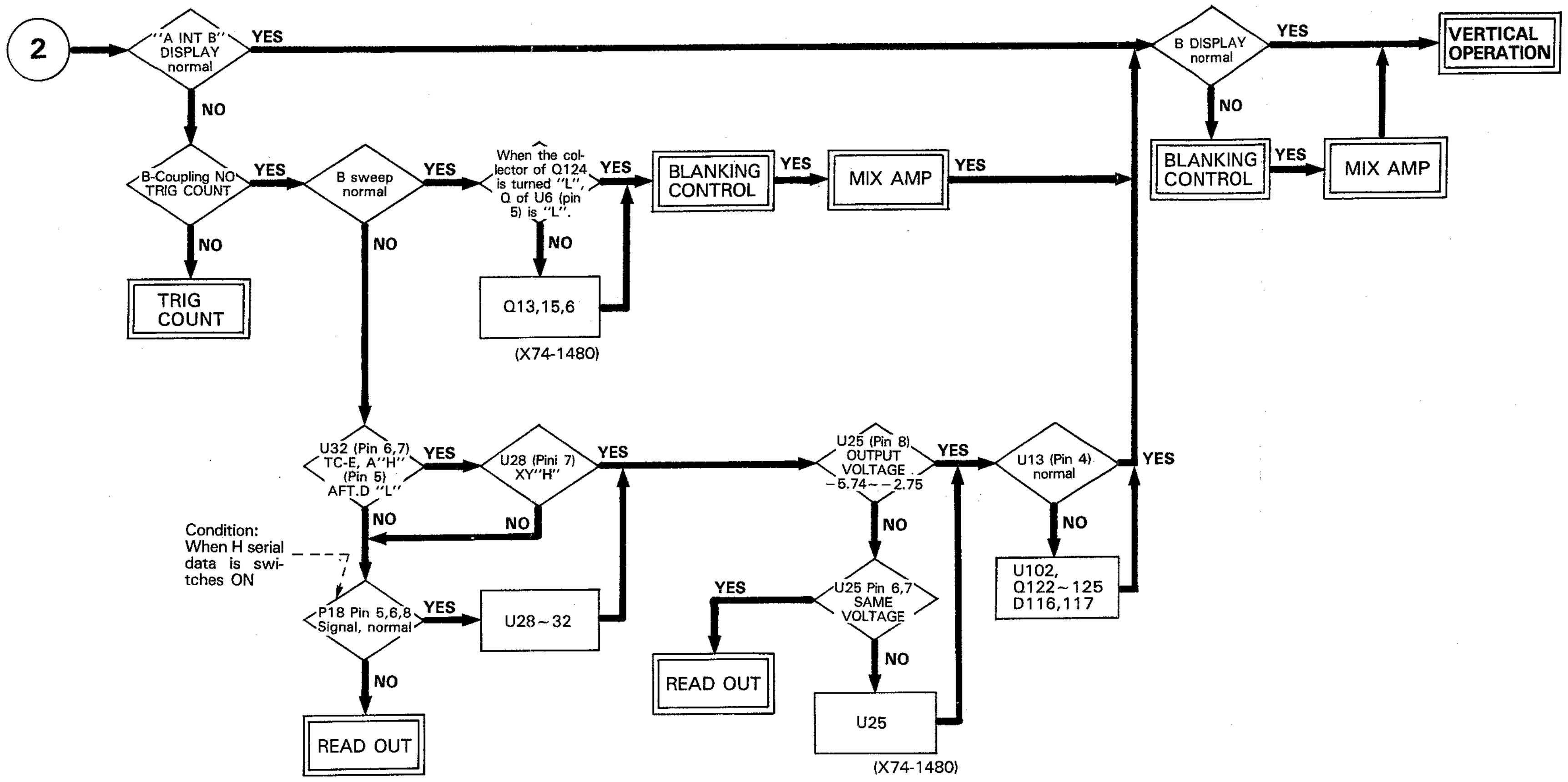

1
P17 Pin4,5 Voltage: +5V
YES
NO
Q7 Emitter Voltage: +7.5V
YES
NO
Q7,D13 U2a
D9
P17, Pin1 Voltage: +15V
YES
NO
Q8 Emitter Voltage: +22V
YES
NO
D10,11
Q8,D12 U1a
END

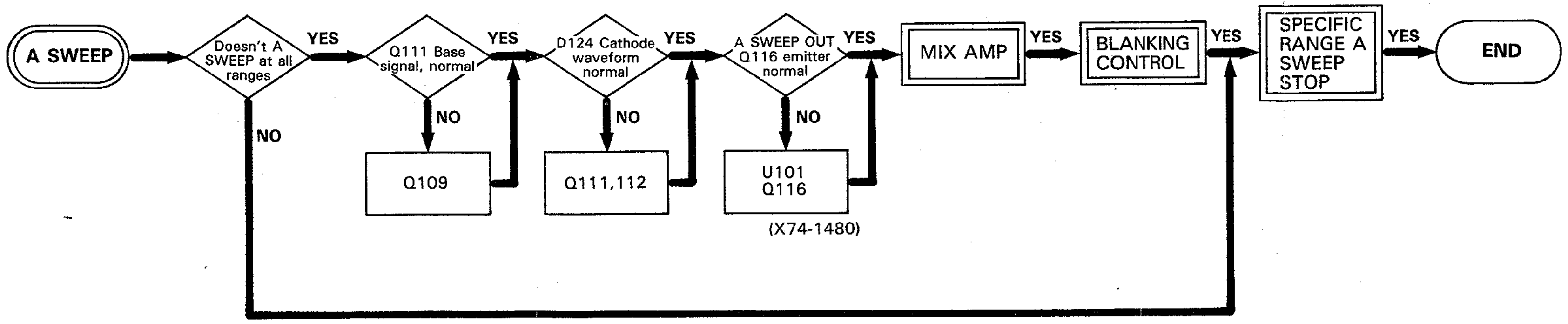
TROUBLESHOOTING


Condition: AUTO
SWEEP
[X74-1480]
"A" DISPLAY normal
YES
NO
1
SUPPLY
NO
U30, HC595 NORM (PIN5) "H"
YES
NO
Condition: When H serial data is switched ON
P18 Pin 5,6,8 Signal, normal
YES
U28~32
NO
READ OUT
U11a (Pin 3) "L"
YES
NO
Q103,104
(X74-1480)
U3a Q10 (Pin 2) "L"
YES
NO
A SWEEP
A SWEEP STOP Q117 Collector "L"
YES
NO
Q117, D115
(X74-1480)
U5 Pin 5 Signal, normal
YES
NO
U5 (Pin5) Q"H"
YES
NO
U5
(X74-1480)
U3 (Pin5) S"H"
YES
NO
U12
(X74-1480)
U3 (Pin 2) Q"H"
YES
NO
U3
(X74-1480)
HOLD OFF normal
YES
NO
Q118~121
(X74-1480)
OUTPUT P18 (Pin30) UNBL normal
YES
NO
BLANKING CONTROL
OUTPUT P18 (Pin 39,40), +X, −X normal
YES
NO
H-MIX AMP

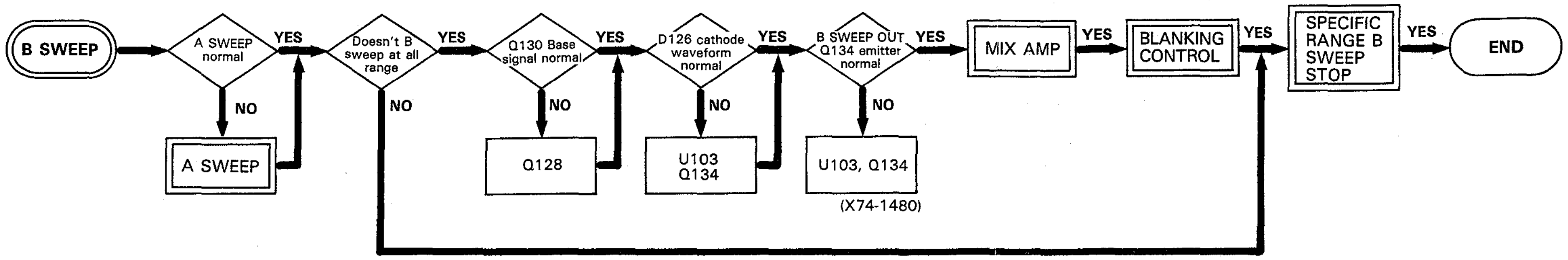

1
A SWEEP TIME normal
YES
NO
A SWEEP
"ALT" DISPLAY, normal
YES
NO
B-Coupling NO TRIG COUNT
YES
NO
TRIG COUNT
U3 Pin15 normal
YES
U3b Q (Pin 15) "H"
YES
NO
B SWEEP
B SWEEP STOP Q135 Collector "L"
YES
NO
Q135,D123
(X74-1480)
U6 Pin 5 Signal, normal
YES
NO
U6 (Pin 4) S"L"
YES
NO
U13
(X14-1480)
U6 (Pin 5) Q"H"
YES
NO
U6
(X74-1480)
OUTPUT P18 (Pin 30) UNBL normal
YES
NO
BLANKING CONTROL
OUTPUT P18 (Pin 39,40) +X, −X normal
YES
NO
H-MIX AMP
B SWEEP TIME/DIV normal
YES
NO
B SWEEP
2

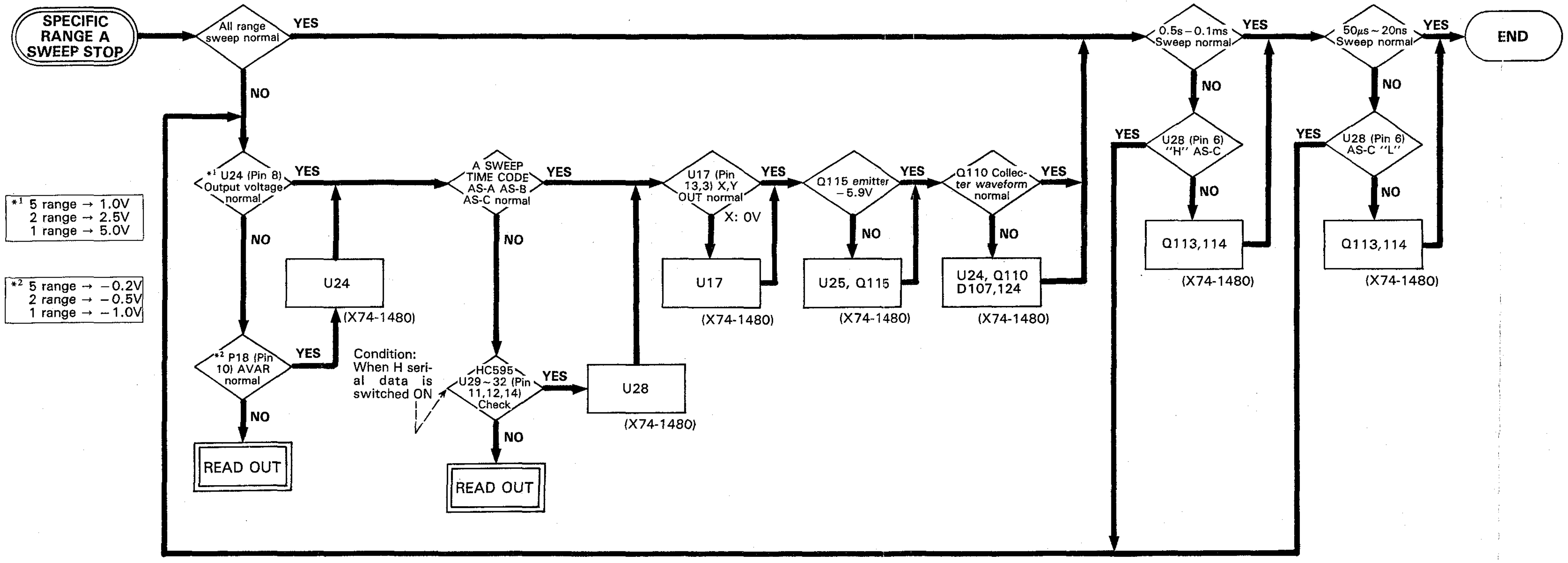
TROUBLESHOOTING

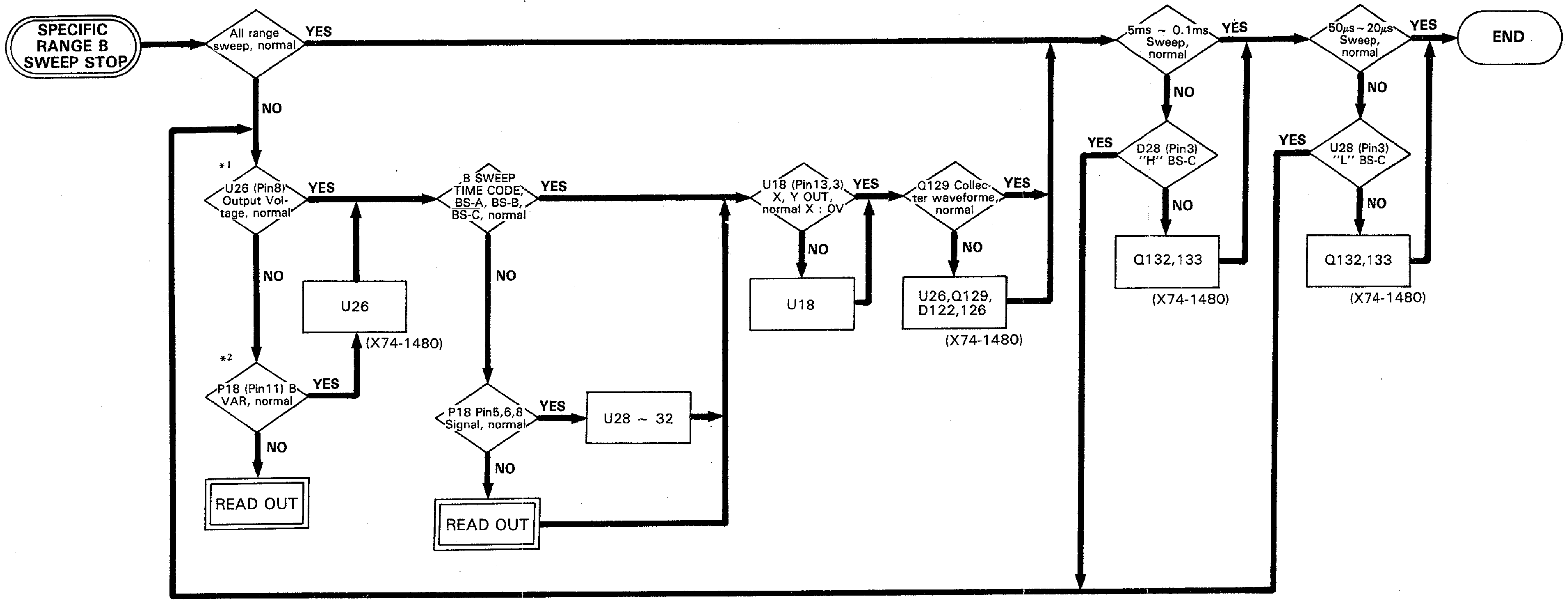

2
"A INT B" DISPLAY normal
YES
NO
B-Coupling NO TRIG COUNT
YES
NO
TRIG COUNT
B sweep normal
YES
NO
When the collector of Q124 is turned "L", Q of U6 (pin 5) is "L".
YES
NO
Q13,15,6
(X74-1480)
BLANKING CONTROL
YES
MIX AMP
YES
B DISPLAY normal
YES
NO
VERTICAL OPERATION
BLANKING CONTROL
YES
MIX AMP
U32 (Pin 6,7) TC-E, A"H" (Pin 5) AFT.D "L"
YES
NO
U28 (Pini 7) XY"H"
YES
NO
Condition: When H serial data is switches ON
P18 Pin 5,6,8 Signal, normal
YES
NO
U28~32
READ OUT
U25 (Pin 8) OUTPUT VOLTAGE −5.74~−2.75
YES
NO
U25 Pin 6,7 SAME VOLTAGE
YES
NO
READ OUT
U25
(X74-1480)
U13 (Pin 4) normal
YES
NO
U102, Q122~125 D116,117


A SWEEP
Doesn't A SWEEP at all ranges
YES
NO
Q111 Base signal, normal
YES
NO
Q109
D124 Cathode waveform normal
YES
NO
Q111,112
A SWEEP OUT Q116 emitter normal
YES
NO
U101 Q116
(X74-1480)
MIX AMP
YES
BLANKING CONTROL
YES
SPECIFIC RANGE A SWEEP STOP
YES
END

TROUBLESHOOTING


B SWEEP
A SWEEP normal
YES
NO
A SWEEP
Doesn't B sweep at all range
YES
NO
Q130 Base signal normal
YES
NO
Q128
D126 cathode waveform normal
YES
NO
U103
Q134
B SWEEP OUT Q134 emitter normal
YES
NO
U103, Q134
(X74-1480)
MIX AMP
YES
BLANKING CONTROL
YES
SPECIFIC RANGE B SWEEP STOP
YES
END


SPECIFIC RANGE A SWEEP STOP
All range sweep normal
YES
NO
*1 5 range → 1.0V
2 range → 2.5V
1 range → 5.0V
*2 5 range → −0.2V
2 range → −0.5V
1 range → −1.0V
*1 U24 (Pin 8) Output voltage normal
YES
NO
U24
(X74-1480)
*2 P18 (Pin 10) AVAR normal
YES
NO
READ OUT
Condition: When H serial data is switched ON
A SWEEP TIME CODE AS-A AS-B AS-C normal
YES
NO
HC595 U29~32 (Pin 11,12,14) Check
YES
NO
U28
(X74-1480)
READ OUT
U17 (Pin 13,3) X,Y OUT normal
X: 0V
YES
U17
(X74-1480)
Q115 emitter −5.9V
YES
NO
U25, Q115
(X74-1480)
Q110 Collecter waveform normal
YES
NO
U24, Q110
D107,124
(X74-1480)
0.5s − 0.1ms Sweep normal
YES
NO
U28 (Pin 6) "H" AS-C
YES
NO
Q113,114
(X74-1480)
50μs ~ 20ns Sweep normal
YES
NO
U28 (Pin 6) AS-C "L"
YES
NO
Q113,114
(X74-1480)
END


SPECIFIC RANGE B SWEEP STOP
All range sweep, normal
YES
NO
*1
U26 (Pin8) Output Voltage, normal
YES
NO
U26
(X74-1480)
*2
P18 (Pin11) B VAR, normal
YES
NO
READ OUT
B SWEEP TIME CODE, BS-A, BS-B, BS-C, normal
YES
NO
P18 Pin5,6,8 Signal, normal
YES
U28 ~ 32
NO
READ OUT
U18 (Pin13,3) X, Y OUT, normal X : 0V
YES
NO
U18
Q129 Collecter waveforme, normal
YES
NO
U26,Q129, D122,126
(X74-1480)
5ms ~ 0.1ms Sweep, normal
YES
NO
D28 (Pin3) "H" BS-C
YES
NO
Q132,133
(X74-1480)
50μs ~ 20μs Sweep, normal
YES
NO
U28 (Pin3) "L" BS-C
YES
NO
Q132,133
(X74-1480)
END

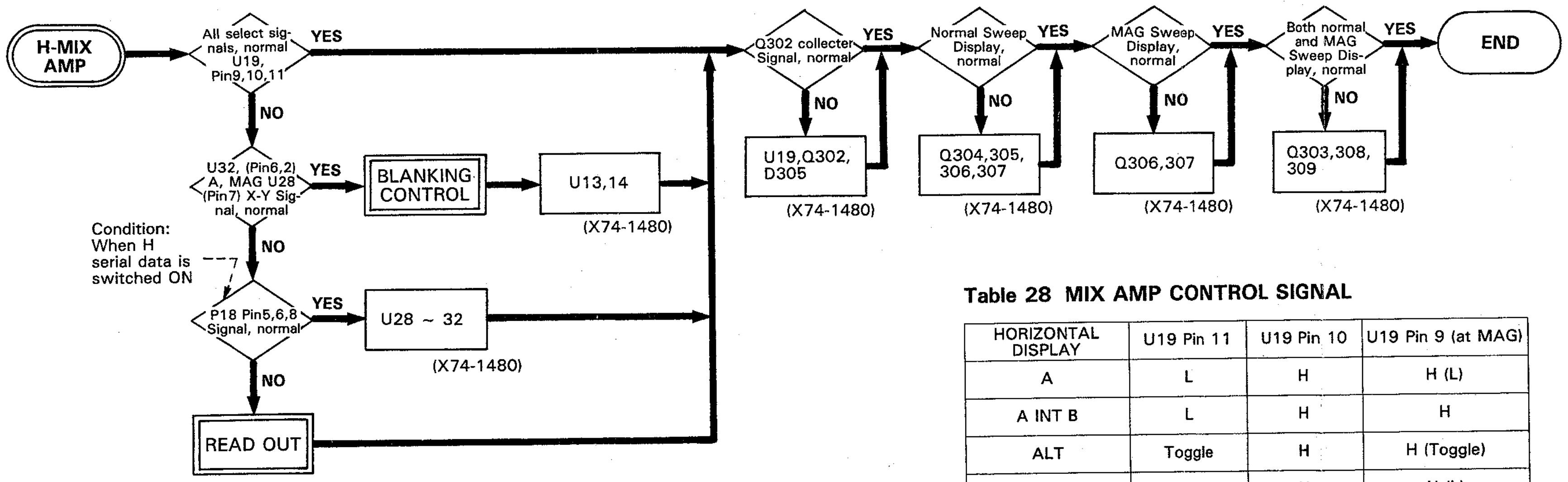
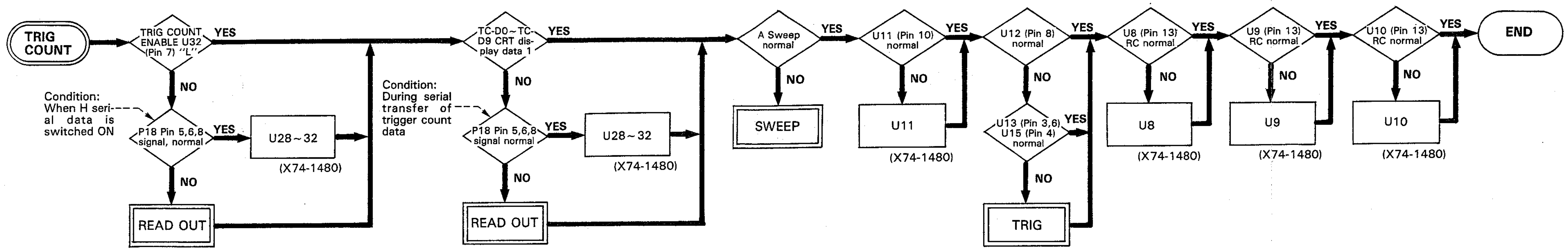
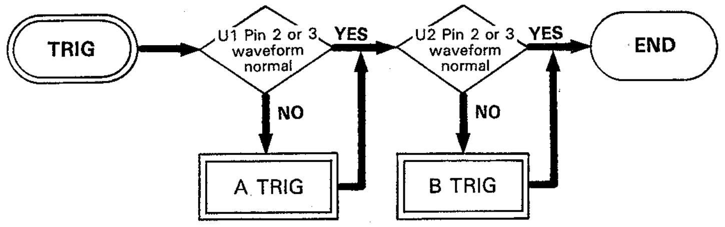

H-MIX AMP
All select signals, normal U19, Pin9,10,11
YES
NO
U32, (Pin6,2) A, MAG U28 (Pin7) X-Y Signal, normal
YES
BLANKING CONTROL
U13,14
(X74-1480)
NO
Condition: When H serial data is switched ON
P18 Pin5,6,8 Signal, normal
YES
U28 ~ 32
(X74-1480)
NO
READ OUT
Q302 collecter Signal, normal
YES
NO
U19,Q302, D305
(X74-1480)
Normal Sweep Display, normal
YES
NO
Q304,305, 306,307
(X74-1480)
MAG Sweep Display, normal
YES
NO
Q306,307
(X74-1480)
Both normal and MAG Sweep Display, normal
YES
NO
Q303,308, 309
(X74-1480)
END

Table 28 MIX AMP CONTROL SIGNAL

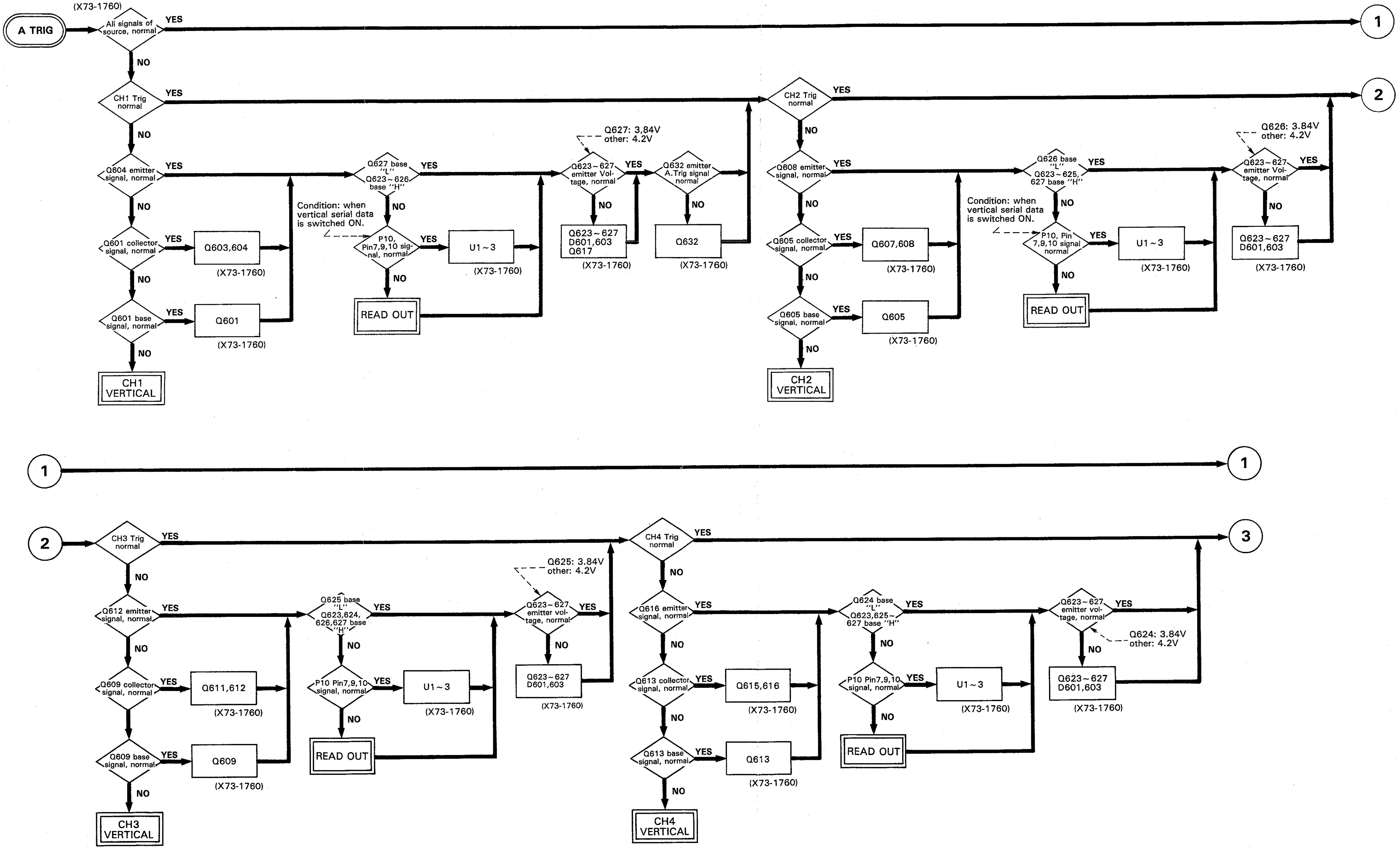
HORIZONTAL DISPLAY	U19 Pin 11	U19 Pin 10	U19 Pin 9 (at MAG)
A	L	H	H (L)
A INT B	L	H	H
ALT	Toggle	H	H (Toggle)
B	H	H	H (L)
X-Y	L	L	H

TROUBLESHOOTING

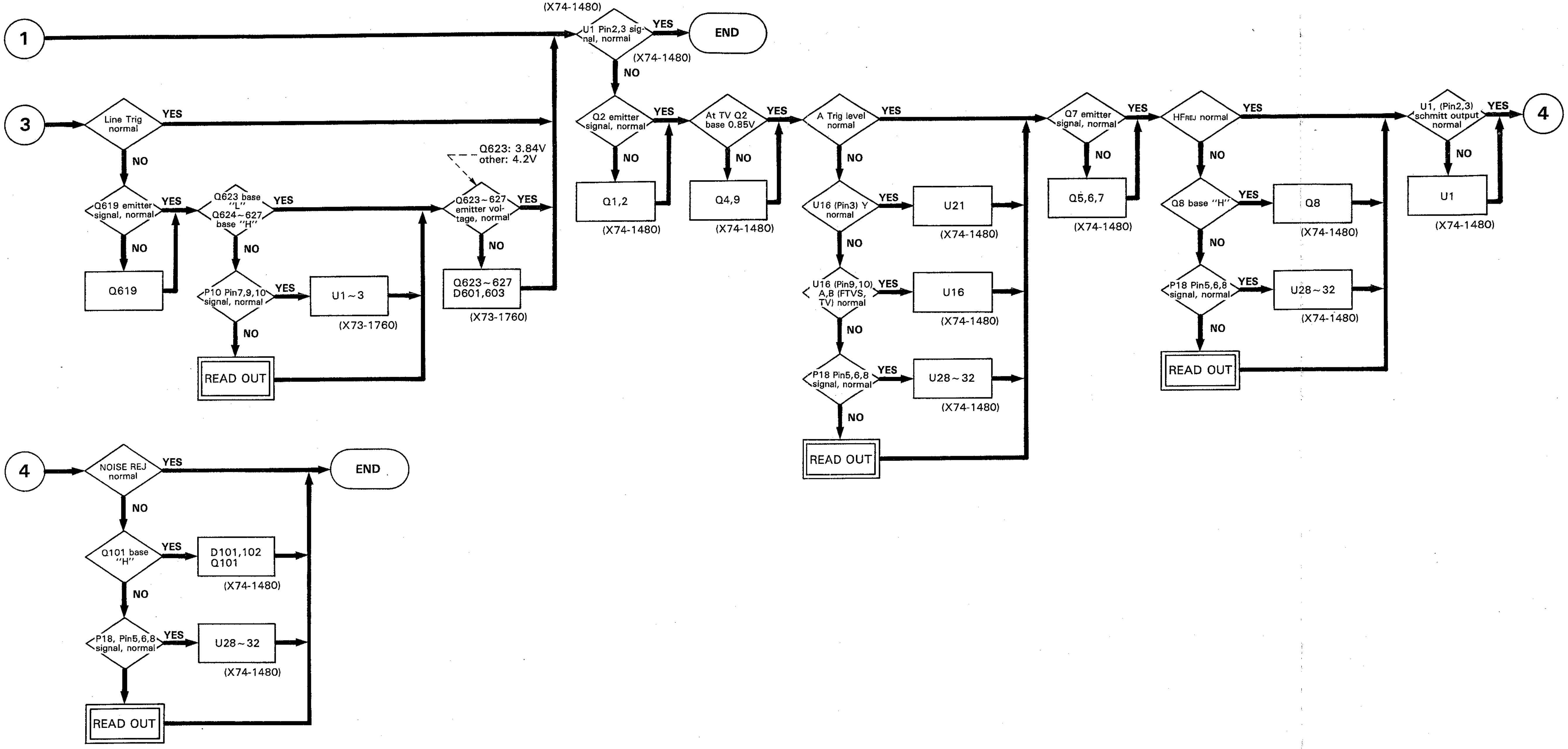

TRIG COUNT
TRIG COUNT ENABLE U32 (Pin 7) "L"
YES
NO
Condition: When H serial data is switched ON
P18 Pin 5,6,8 signal, normal
YES
U28~32
(X74-1480)
NO
READ OUT
TC-D0~TC-D9 CRT display data 1
YES
NO
Condition: During serial transfer of trigger count data
P18 Pin 5,6,8 signal normal
YES
U28~32
(X74-1480)
NO
READ OUT
A Sweep normal
YES
NO
SWEEP
U11 (Pin 10) normal
YES
NO
U11
(X74-1480)
U12 (Pin 8) normal
YES
NO
U13 (Pin 3,6) U15 (Pin 4) normal
YES
NO
TRIG
U8 (Pin 13) RC normal
YES
NO
U8
(X74-1480)
U9 (Pin 13) RC normal
YES
NO
U9
(X74-1480)
U10 (Pin 13) RC normal
YES
NO
U10
(X74-1480)
END


TRIG
U1 Pin 2 or 3 waveform normal
YES
NO
A TRIG
U2 Pin 2 or 3 waveform normal
YES
NO
B TRIG
END

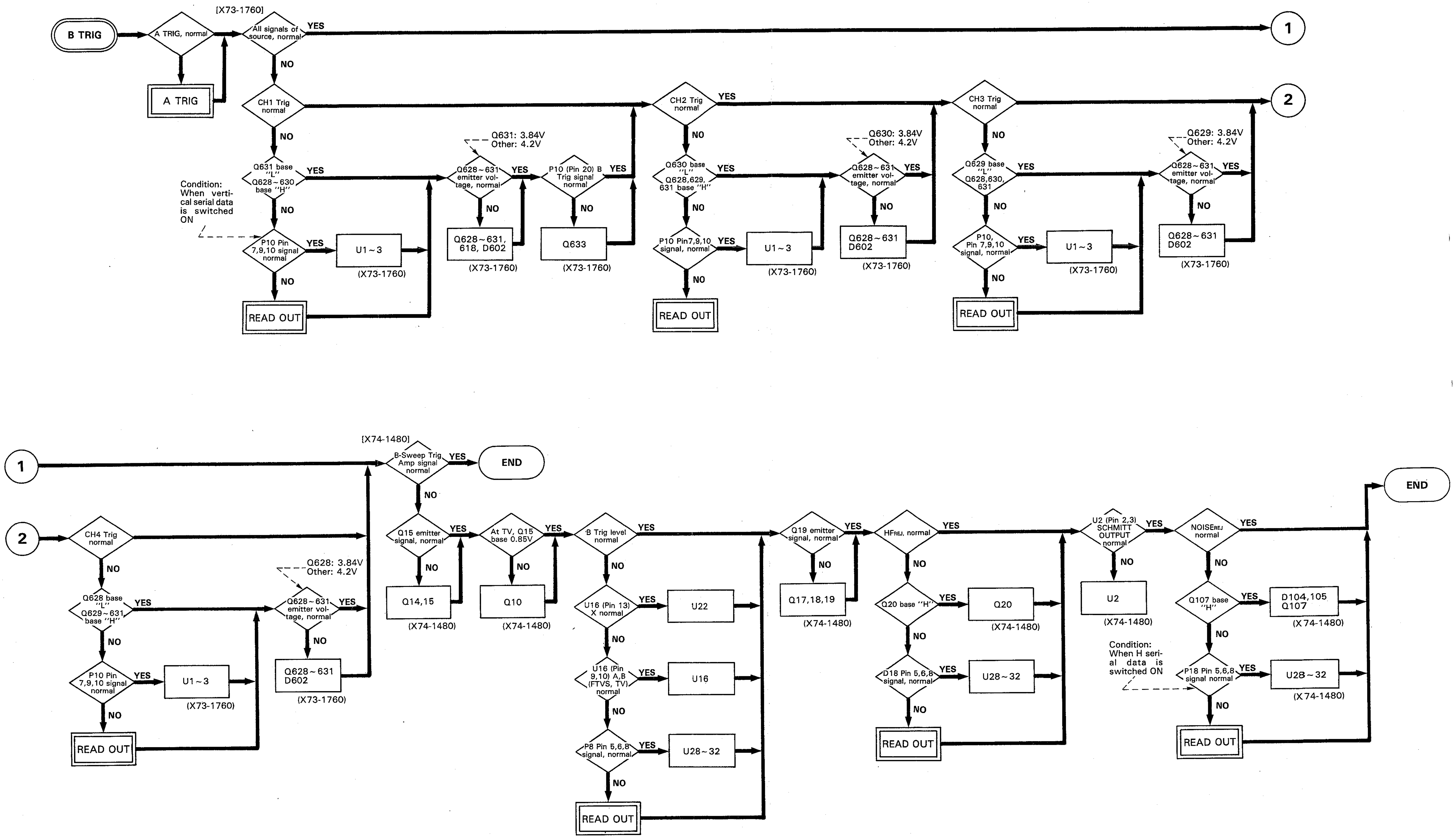
TROUBLESHOOTING


A TRIG
(X73-1760)
All signals of source, normal
YES
NO
1
CH1 Trig normal
CH2 Trig normal
2
Q604 emitter signal, normal
Q627 base "L" Q623~626 base "H"
Q627: 3,84V other: 4.2V
Q623~627 emitter Voltage, normal
Q632 emitter A.Trig signal normal
Condition: when vertical serial data is switched ON.
P10, Pin7,9,10 signal, normal
U1~3
READ OUT
Q623~627 D601,603 Q617
Q632
Q601 collector signal, normal
Q603,604
Q601 base signal, normal
Q601
CH1 VERTICAL
Q608 emitter signal, normal
Q605 collector signal, normal
Q607,608
Q605 base signal, normal
Q605
CH2 VERTICAL
Q626 base "L" Q623~625, 627 base "H"
Q626: 3.84V other: 4.2V
Q623~627 emitter Voltage, normal
P10, Pin 7,9,10 signal normal
Q623~627 D601,603
CH3 Trig normal
CH4 Trig normal
3
Q612 emitter signal, normal
Q625 base "L" Q623,624, 626,627 base "H"
Q625: 3.84V other: 4.2V
Q623~627 emitter voltage, normal
Q609 collector signal, normal
Q611,612
P10 Pin7,9,10 signal, normal
Q609 base signal, normal
Q609
CH3 VERTICAL
Q616 emitter signal, normal
Q624 base "L" Q623,625~627 base "H"
Q623~627 emitter voltage, normal
Q624: 3.84V other: 4.2V
Q613 collector signal, normal
Q615,616
Q613 base signal, normal
Q613
CH4 VERTICAL

TROUBLESHOOTING


1
(X74-1480)
U1 Pin2,3 signal, normal
YES
END
(X74-1480)
NO
3
Line Trig normal
YES
NO
Q2 emitter signal, normal
YES
NO
Q1,2
(X74-1480)
At TV Q2 base 0.85V
YES
NO
Q4,9
(X74-1480)
A Trig level normal
YES
NO
U16 (Pin3) Y normal
YES
U21
(X74-1480)
NO
U16 (Pin9,10) A,B (FTVS, TV) normal
YES
U16
(X74-1480)
NO
P18 Pin5,6,8 signal, normal
YES
U28~32
(X74-1480)
NO
READ OUT
Q7 emitter signal, normal
YES
NO
Q5,6,7
(X74-1480)
HFREJ normal
YES
NO
Q8 base "H"
YES
Q8
(X74-1480)
NO
P18 Pin5,6,8 signal, normal
YES
U28~32
(X74-1480)
NO
READ OUT
U1, (Pin2,3) schmitt output normal
YES
4
NO
U1
(X74-1480)
Q619 emitter signal, normal
YES
NO
Q619
Q623 base "L" Q624~627 base "H"
YES
NO
P10 Pin7,9,10 signal, normal
YES
U1~3
(X73-1760)
NO
READ OUT
Q623: 3.84V
other: 4.2V
Q623~627 emitter voltage, normal
YES
NO
Q623~627
D601,603
(X73-1760)
4
NOISE REJ normal
YES
END
NO
Q101 base "H"
YES
D101,102
Q101
(X74-1480)
NO
P18, Pin5,6,8 signal, normal
YES
U28~32
(X74-1480)
READ OUT

TROUBLESHOOTING


B TRIG
A TRIG, normal
A TRIG
[X73-1760]
All signals of source, normal
YES
NO
1
CH1 Trig normal
Q631 base "L" Q628~630 base "H"
Condition: When vertical serial data is switched ON
P10 Pin 7,9,10 signal normal
U1~3
(X73-1760)
READ OUT
Q631: 3.84V
Other: 4.2V
Q628~631 emitter voltage, normal
Q628~631, 618, D602
(X73-1760)
P10 (Pin 20) B Trig signal normal
Q633
(X73-1760)
CH2 Trig normal
Q630 base "L" Q628,629, 631 base "H"
P10 Pin7,9,10 signal, normal
U1~3
(X73-1760)
READ OUT
Q630: 3.84V
Other: 4.2V
Q628~631 emitter voltage, normal
Q628~631 D602
(X73-1760)
CH3 Trig normal
2
Q629 base "L" Q628,630, 631
P10, Pin 7,9,10 signal, normal
U1~3
(X73-1760)
READ OUT
Q629: 3.84V
Other: 4.2V
Q628~631 emitter voltage, normal
Q628~631 D602
(X73-1760)
1
2
[X74-1480]
B-Sweep Trig Amp signal normal
END
CH4 Trig normal
Q628 base "L" Q629~631 base "H"
P10 Pin 7,9,10 signal normal
U1~3
(X73-1760)
READ OUT
Q628: 3.84V
Other: 4.2V
Q628~631 emitter voltage, normal
Q628~631 D602
(X73-1760)
Q15 emitter signal, normal
Q14,15
(X74-1480)
At TV, Q15 base 0.85V
Q10
(X74-1480)
B Trig level normal
U16 (Pin 13) X normal
U22
U16 (Pin 9,10) A,B (FTVS, TV) normal
U16
P8 Pin 5,6,8 signal, normal
U28~32
READ OUT
Q19 emitter signal, normal
Q17,18,19
(X74-1480)
HF_{REJ}, normal
Q20 base "H"
Q20
(X74-1480)
D18 Pin 5,6,8 signal, normal
U28~32
READ OUT
U2 (Pin 2,3) SCHMITT OUTPUT normal
U2
(X74-1480)
Condition: When H serial data is switched ON
NOISE_{REJ} normal
Q107 base "H"
D104,105 Q107
(X74-1480)
P18 Pin 5,6,8 signal normal
U28~32
(X74-1480)
READ OUT
END
YES
NO

TROUBLESHOOTING

ATT Unit Serial Data Active Level

ATT Code (CH1 and CH2)

	1/2* U3 Pin6 (U3 Pin3)	1/4* U3 Pin5 (U3 Pin2)	1/10 U1 Pin6 (U1 Pin2)	1/100 U1 Pin7 (U1 Pin3)	MAG* U3 Pin7 (U3 Pin4)	CH1 (CH2) Display
1 mV	L	L	L	L	L	1 mV
2 mV	H	L	L	L	L	2 mV
5 mV	L	L	L	L	H	5 mV
10 mV	H	L	L	L	H	10 mV
20 mV	L	H	L	L	H	20 mV
50 mV	L	L	H	L	H	50 mV
0.1 V	H	L	H	L	H	0.1 V
0.2 V	L	H	H	L	H	0.2 V
0.5 V	L	L	L	H	H	0.5 V
1 V	H	L	L	H	H	1 V
2 V	L	H	L	H	H	2 V
5 V	L	L	H	H	H	5 V

(   ) CH2
*1/2, 1/4, MAG Signal Vertical Unit IC.

ATT Code (CH3 and CH4)

	CH3 U2 Pin1	CH4 U2 Pin2	Display
0.1V	H	H	0.1
0.5V	L	L	0.5

CH1,CH2 Coupling	Active	Output IC	Display
CH1 AC	L	U1 Pin4	mV or Ṽ
CH1 GND	L	U1 Pin5	⏚
CH2 AC	L	U1 Pin15	mV or Ṽ
CH2 GND	L	U1 Pin1	⏚

CH2 Polarity	U2 Pin3	Display
Normal	H	space
Invert	L	

Vertical Unit Serial Data Active Level

A-Source	Active	Output IC
CH1	L	U2 Pin 4
CH2	L	U2 Pin 3
CH3	L	U2 Pin 2
CH4	L	U2 Pin 1
LINE	L	U2 Pin 15

B-Source	Active	Output IC
CH1	L	U1 Pin 2
CH2	L	U1 Pin 1
CH3	L	U1 Pin 15
CH4	L	U2 Pin 5

V-Mode	Active	Output IC
CH1E	L	U1 Pin 7
CH2E	L	U1 Pin 6
CH3E	L	U1 Pin 5
CH4E	L	U1 Pin 4
ADDE	L	U1 Pin 3

20MHz BWL	Active	Output IC	Display
BW	L	U3 Pin 1	Bw

Horizontal Unit Serial Data Active Level

(A-Coupling)	Active	Output IC	Condition
AC	L	U29 Pin 7	A Coupling"AC" or A-Source "LINE"
NOISE$_{REJ}$	H	U29 Pin 5	A-Coupling "NOISE$_{REJ}$"
HF$_{REJ}$	H	U29 Pin 6	A-Coupling "HF$_{REJ}$" or "TV-V" or A-Source "LINE"
TV	H	U29 Pin 4	A-Coupling "TV-V" or "TV-H"
(B-Coupling)			
AC	L	U29 Pin 15	B-Coupling "AC"
NOISE$_{REJ}$	H	U29 Pin 2	B-Coupling "NOISE$_{REJ}$"
HF$_{REJ}$	H	U29 Pin 1	B-Coupling "HF$_{REJ}$"
FTVS	H	U29 Pin 3	A-Coupling "TV-V" "TV-H" and Slope "−" or "FIX"

ASLOPE	U30 Pin 7
+	H
−	L

B SLOPE	U30 Pin 6
+	H
−	L

SWEEP MODE	U30 Pin 5	Condition
NORMAL	L	Non "AUTO" or "X-Y"

HORIZONTAL MODE	Active	Output IC	Condition	Display
A	L	U32 Pin 6	Horizontal Mode "A"	A Sweep Time
ALT	L	U32 Pin 1	Horizontal Mode "ALT"	A, B Sweep Time
B	L	U32 Pin 3	Horizontal Mode "B"	A, B Sweep Time
X, Y	L	U28 Pin 7	Horizontal Mode "X, Y"	"CH2-X"
X-Y SGL	H	U32 Pin 4	Horizontal Mode "X-Y" and single sweep	

MAG	U32 Pin 2	Condition
normal	H	Horizontal Mode "A INT B" or "X-Y" or MAG normal
X10 MAG	L	

Single Sweep	Active	Output IC
Single	L	U30 Pin 2

CHOP	Active	Output IC
CHOP	L	U30 Pin 15

Trig Count	Active	Output IC	Display
TC-E (Trig count Enable)	L	U32 Pin 7	COUNT
	D9 D0		
TC-D0	0000000000	U30 Pin 1	COUNT 1
TC-D1	0000000001	U30 Pin 15	COUNT 2
TC-D2	0000000010	U31 Pin 7	COUNT 3
TC-D3	.	U31 Pin 6	.
TC-D4	.	U31 Pin 5	.
TC-D5	.	U31 Pin 4	.
TC-D6	.	U31 Pin 3	.
TC-D7	.	U31 Pin 2	.
TC-D8	.	U31 Pin 1	.
TC-D9	1111100111	U31 Pin 15	COUNT 1000

B (TV)	A (FTVS)	Y	X
0	0	Y0 (ALVL)	Y0 (BLVL)
0	1	Y1 (FIX)	X1 (BLVL) (X0=X1)
1	0	Y2 (TV+)	X2 (TV+)
1	1	Y3 (TV−)	X3 (TV−)

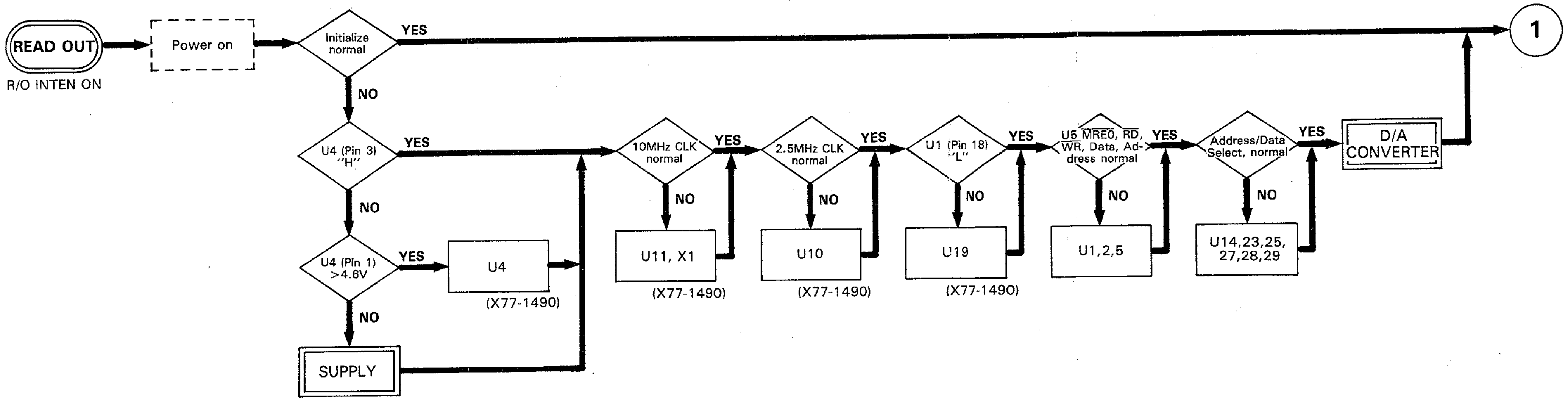
X74-1480
U16 Analog SW Control signal

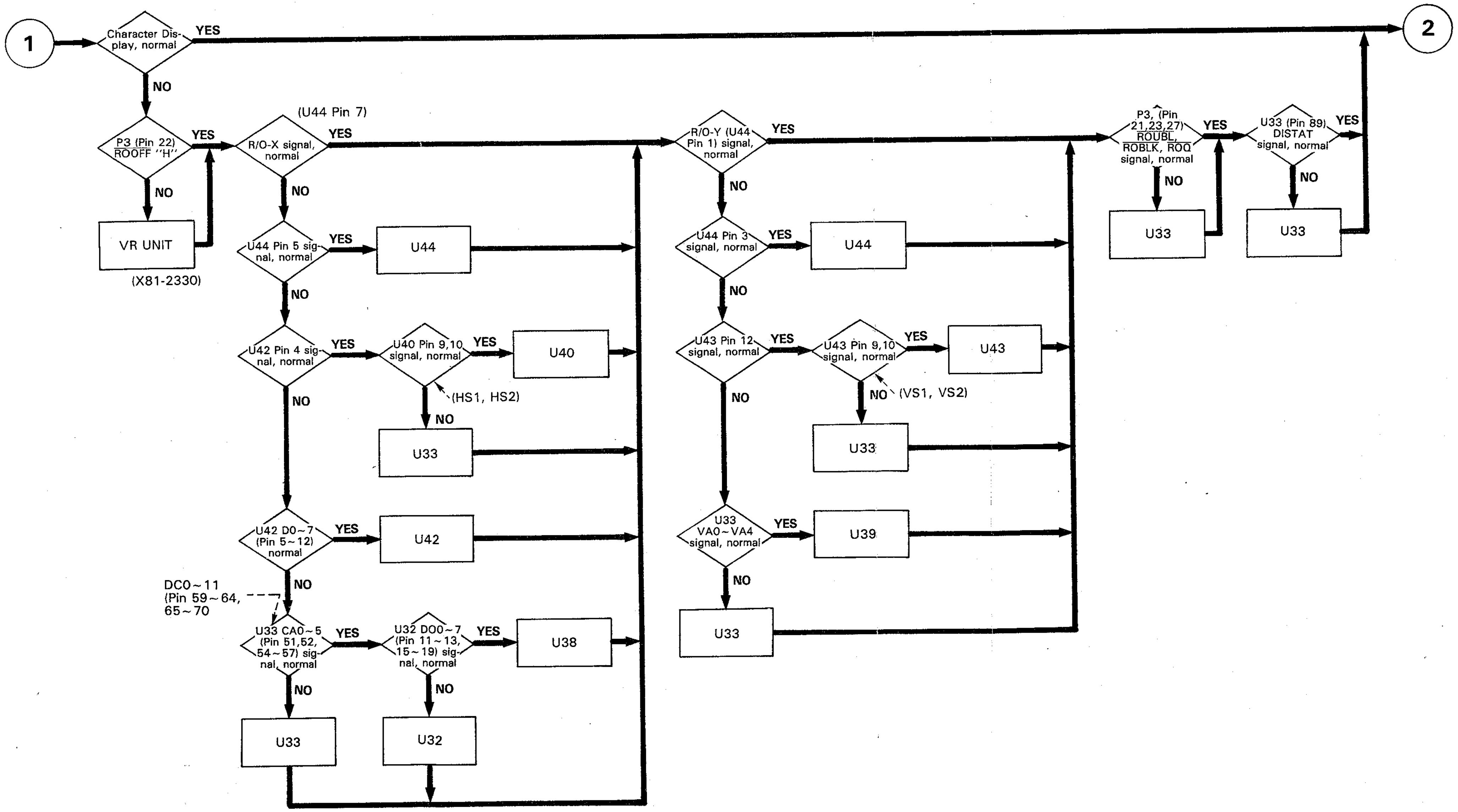
TV...TV-V or TV-H "H" other "L"
FTVS...Fix or TV SLOPE ⊖ "H" other "L"

SWEEP TIME CODE

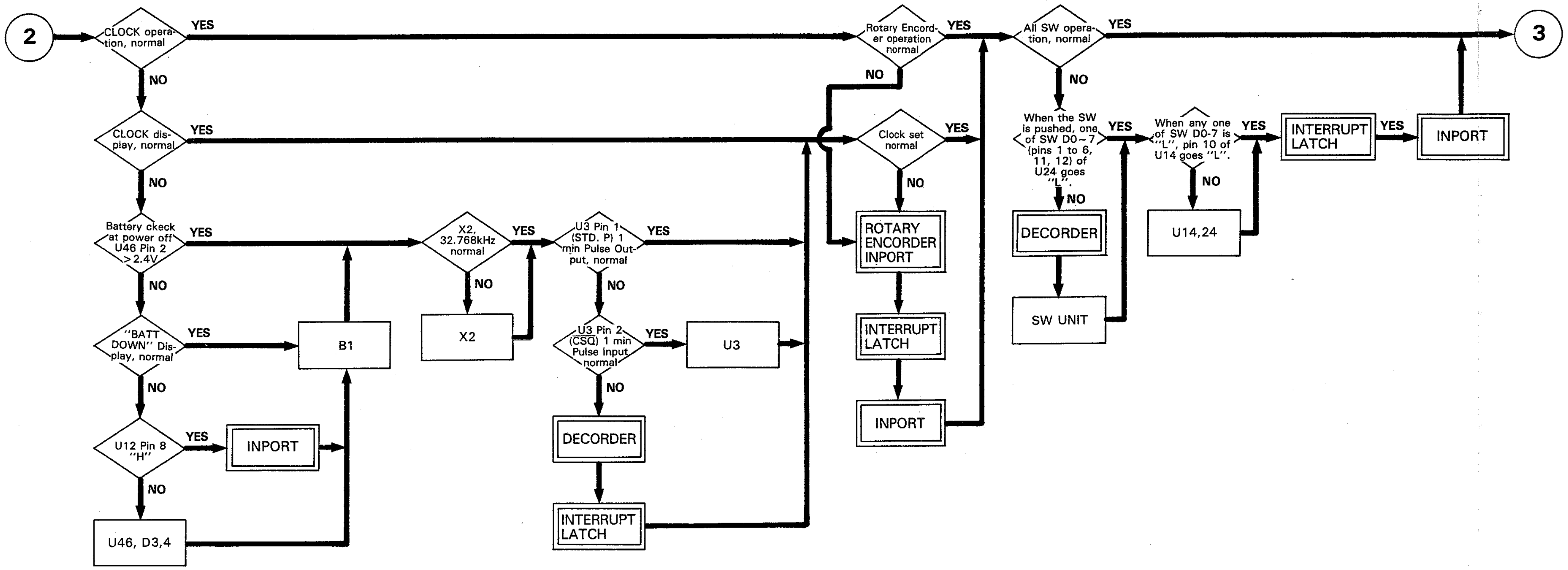
	A Sweep Time Code			B Sweep Time Code		
Sweep Time	AS-A	AS-B	AS-C	BS-A	BS-B	BS-C
0.5s	0	0	0			
0.2s	0	0	0			
0.1s	0	0	0			
50ms	1	0	0			
20ms	1	0	0			
10ms	1	0	0			
5ms	0	1	0	0	1	0
2ms	0	1	0	0	1	0
1ms	0	1	0	0	1	0
0.5ms	1	1	0	1	1	0
0.2ms	1	1	0	1	1	0
0.1ms	1	1	0	1	1	0
50μs	0	0	1	0	0	1
20μs	0	0	1	0	0	1
10μs	0	0	1	0	0	1
5μs	1	0	1	1	0	1
2μs	1	0	1	1	0	1
1μs	1	0	1	1	0	1
0.5μs	0	1	1	0	1	1
0.2μs	0	1	1	0	1	1
0.1μs	0	1	1	0	1	1
50ns	1	1	1	1	1	1
20ns	1	1	1	1	1	1

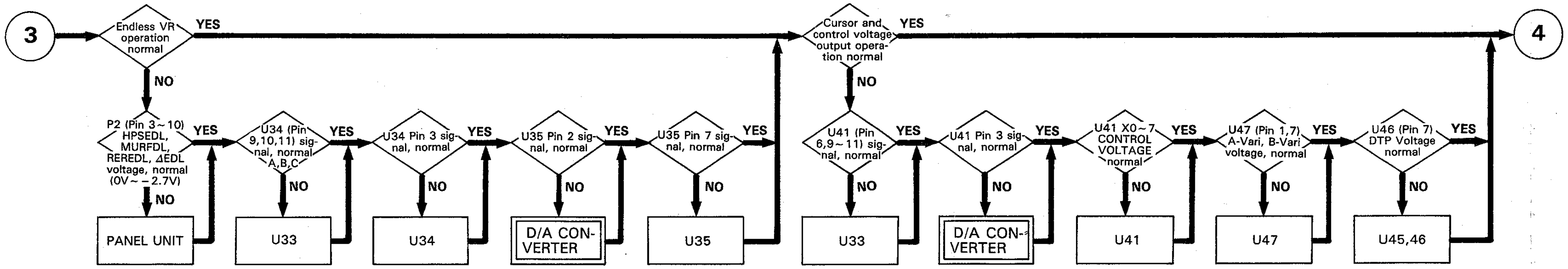
TROUBLESHOOTING

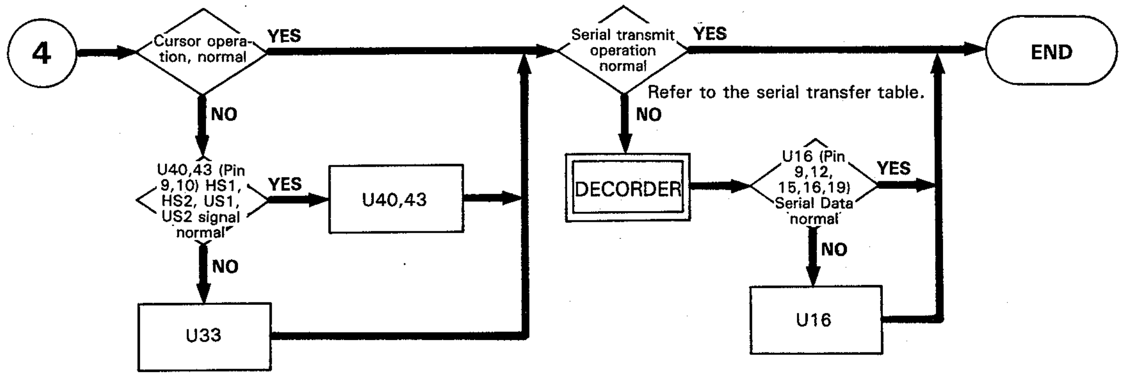

READ OUT
R/O INTEN ON
Power on
Initialize normal
YES
NO
1
U4 (Pin 3) "H"
U4 (Pin 1) >4.6V
U4
(X77-1490)
SUPPLY
10MHz CLK normal
U11, X1
(X77-1490)
2.5MHz CLK normal
U10
(X77-1490)
U1 (Pin 18) "L"
U19
(X77-1490)
U5 MREO, RD, WR, Data, Address normal
U1,2,5
Address/Data Select, normal
U14,23,25, 27,28,29
D/A CONVERTER


1
Character Display, normal
YES
NO
2
P3 (Pin 22) ROOFF "H"
VR UNIT
(X81-2330)
(U44 Pin 7)
R/O-X signal, normal
U44 Pin 5 signal, normal
U44
U42 Pin 4 signal, normal
U40 Pin 9,10 signal, normal
U40
(HS1, HS2)
U33
U42 D0~7 (Pin 5~12) normal
U42
DC0~11 (Pin 59~64, 65~70
U33 CA0~5 (Pin 51,52, 54~57) signal, normal
U32 DO0~7 (Pin 11~13, 15~19) signal, normal
U38
U33
U32
R/O-Y (U44 Pin 1) signal, normal
U44 Pin 3 signal, normal
U44
U43 Pin 12 signal, normal
U43 Pin 9,10 signal, normal
U43
(VS1, VS2)
U33
U33 VA0~VA4 signal, normal
U39
U33
P3, (Pin 21,23,27) ROUBL, ROBLK, ROQ signal, normal
U33
U33 (Pin 89) DISTAT signal, normal
U33

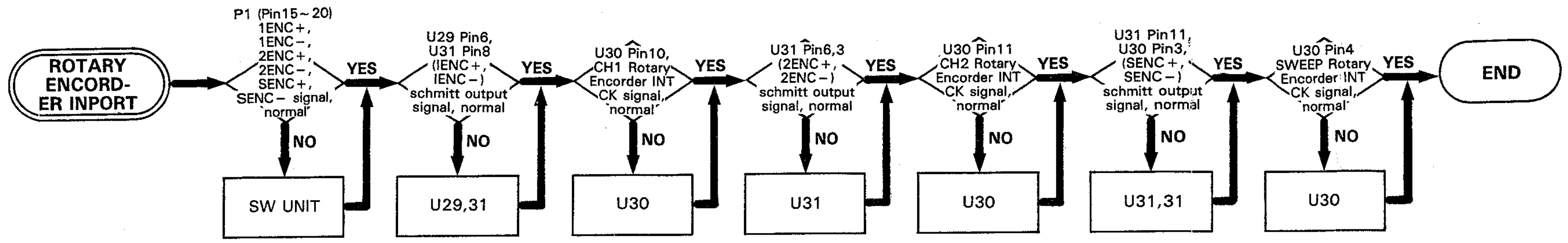
TROUBLESHOOTING

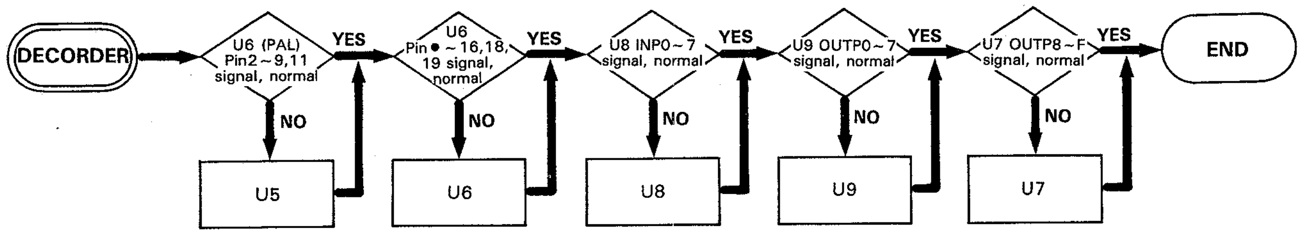

2
CLOCK operation, normal
YES
NO
CLOCK display, normal
YES
NO
Battery ckeck at power off U46 Pin 2 >2.4V
YES
NO
"BATT DOWN" Display, normal
YES
NO
U12 Pin 8 "H"
YES
NO
INPORT
U46, D3,4
B1
X2, 32.768kHz normal
YES
NO
X2
U3 Pin 1 (STD. P) 1 min Pulse Output, normal
YES
NO
U3 Pin 2 (CSQ) 1 min Pulse Input normal
YES
NO
U3
DECORDER
INTERRUPT LATCH
Rotary Encorder operation normal
YES
NO
Clock set normal
YES
NO
ROTARY ENCORDER INPORT
INTERRUPT LATCH
INPORT
All SW operation, normal
YES
NO
When the SW is pushed, one of SW D0~7 (pins 1 to 6, 11, 12) of U24 goes "L".
YES
NO
DECORDER
SW UNIT
When any one of SW D0-7 is "L", pin 10 of U14 goes "L".
YES
NO
U14,24
INTERRUPT LATCH
YES
INPORT
3

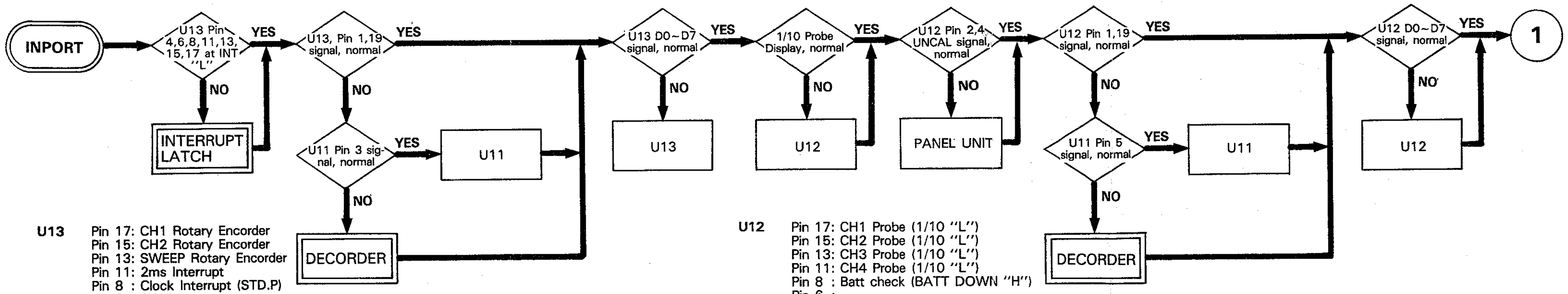

3
Endless VR operation normal
YES
NO
P2 (Pin 3~10) HPSEDL, MURFDL, REREDL, ⊿EDL voltage, normal (0V~−2.7V)
YES
NO
PANEL UNIT
U34 (Pin 9,10,11) signal, normal A,B,C
YES
NO
U33
U34 Pin 3 signal, normal
YES
NO
U34
U35 Pin 2 signal, normal
YES
NO
D/A CONVERTER
U35 Pin 7 signal, normal
YES
NO
U35
Cursor and control voltage output operation normal
YES
NO
U41 (Pin 6,9~11) signal, normal
YES
NO
U33
U41 Pin 3 signal, normal
YES
NO
D/A CONVERTER
U41 X0~7 CONTROL VOLTAGE normal
YES
NO
U41
U47 (Pin 1,7) A-Vari, B-Vari voltage, normal
YES
NO
U47
U46 (Pin 7) DTP Voltage normal
YES
NO
U45,46
4


4
Cursor operation, normal
YES
NO
U40,43 (Pin 9,10) HS1, HS2, US1, US2 signal normal
YES
NO
U40,43
U33
Serial transmit operation normal
YES
Refer to the serial transfer table.
NO
DECORDER
U16 (Pin 9,12, 15,16,19) Serial Data normal
YES
NO
U16
END

TROUBLESHOOTING


ROTARY ENCORD-ER INPORT
P1 (Pin15~20) 1ENC+, 1ENC−, 2ENC+, 2ENC−, SENC+, SENC− signal, normal
YES
NO
SW UNIT
U29 Pin6, U31 Pin8 (IENC+, IENC−) schmitt output signal, normal
U29,31
U30 Pin10, CH1 Rotary Encorder INT CK signal, normal
U30
U31 Pin6,3 (2ENC+, 2ENC−) schmitt output signal, normal
U31
U30 Pin11 CH2 Rotary Encorder INT CK signal, normal
U30
U31 Pin11, U30 Pin3, (SENC+, SENC−) schmitt output signal, normal
U31,31
U30 Pin4 SWEEP Rotary Encorder INT CK signal, normal
U30
END

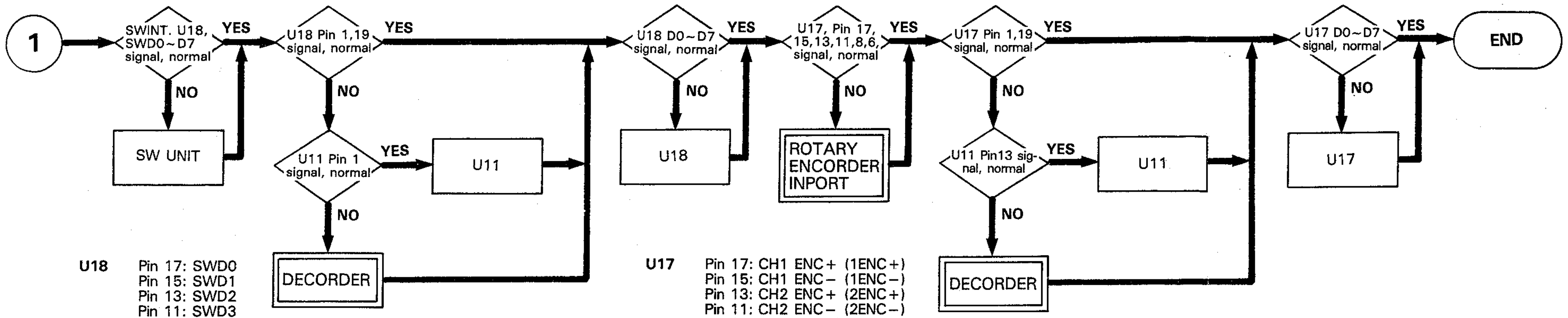

DECORDER
U6 (PAL) Pin2~9,11 signal, normal
YES
NO
U5
U6 Pin● ~16,18, 19 signal, normal
U6
U8 INP0~7 signal, normal
U8
U9 OUTP0~7 signal, normal
U9
U7 OUTP8~F signal, normal
U7
END


INPORT
U13 Pin 4,6,8,11,13, 15,17 at INT "L"
YES
NO
INTERRUPT LATCH
U13, Pin 1,19 signal, normal
U11 Pin 3 signal, normal
U11
DECORDER
U13 D0~D7 signal, normal
U13
1/10 Probe Display, normal
U12
U12 Pin 2,4 UNCAL signal, normal
PANEL UNIT
U12 Pin 1,19 signal, normal
U11 Pin 5 signal, normal
U11
DECORDER
U12 D0~D7 signal, normal
U12
1

U13
Pin 17: CH1 Rotary Encorder
Pin 15: CH2 Rotary Encorder
Pin 13: SWEEP Rotary Encorder
Pin 11: 2ms Interrupt
Pin 8 : Clock Interrupt (STD.P)
Pin 6 : SW Interrupt
Pin 4 : DISTAT
Pin 2 : "L" (always)

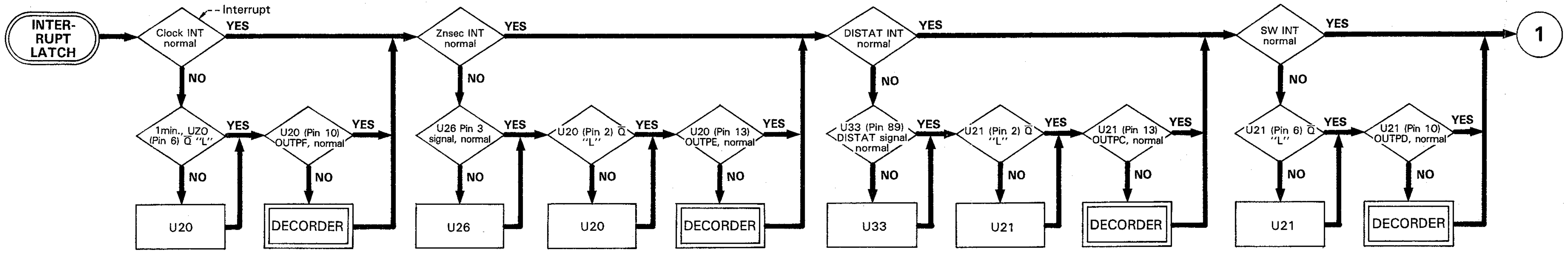
U12
Pin 17: CH1 Probe (1/10 "L")
Pin 15: CH2 Probe (1/10 "L")
Pin 13: CH3 Probe (1/10 "L")
Pin 11: CH4 Probe (1/10 "L")
Pin 8 : Batt check (BATT DOWN "H")
Pin 6 :
Pin 4 : CH1 UNCAL (UNCAL "H")
Pin 2 : CH2 UNCAL (UNCAL "H")

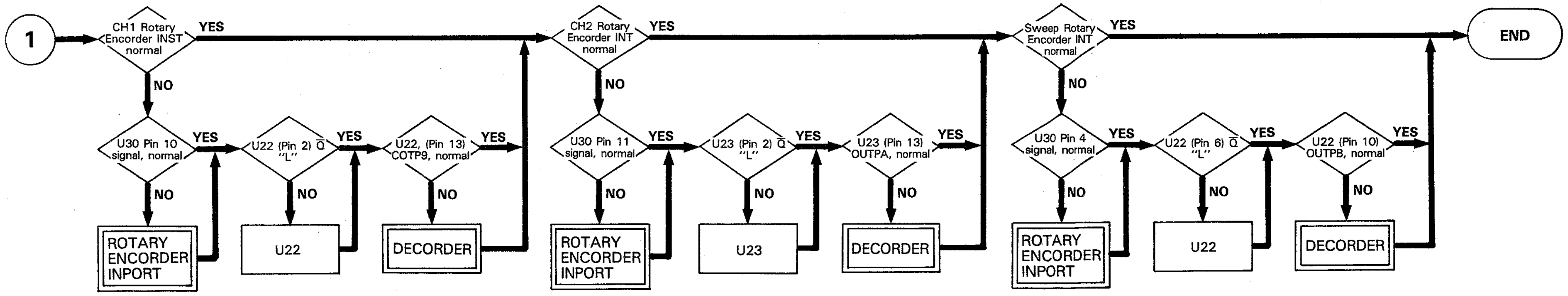
TROUBLESHOOTING


1
SWINT. U18, SWD0~D7 signal, normal
YES
NO
SW UNIT
U18 Pin 1,19 signal, normal
YES
NO
U11 Pin 1 signal, normal
YES
U11
NO
DECORDER
U18 D0~D7 signal, normal
YES
NO
U18
U17, Pin 17, 15,13,11,8,6, signal, normal
YES
NO
ROTARY ENCORDER INPORT
U17 Pin 1,19 signal, normal
YES
NO
U11 Pin13 signal, normal
YES
U11
NO
DECORDER
U17 D0~D7 signal, normal
YES
NO
U17
END

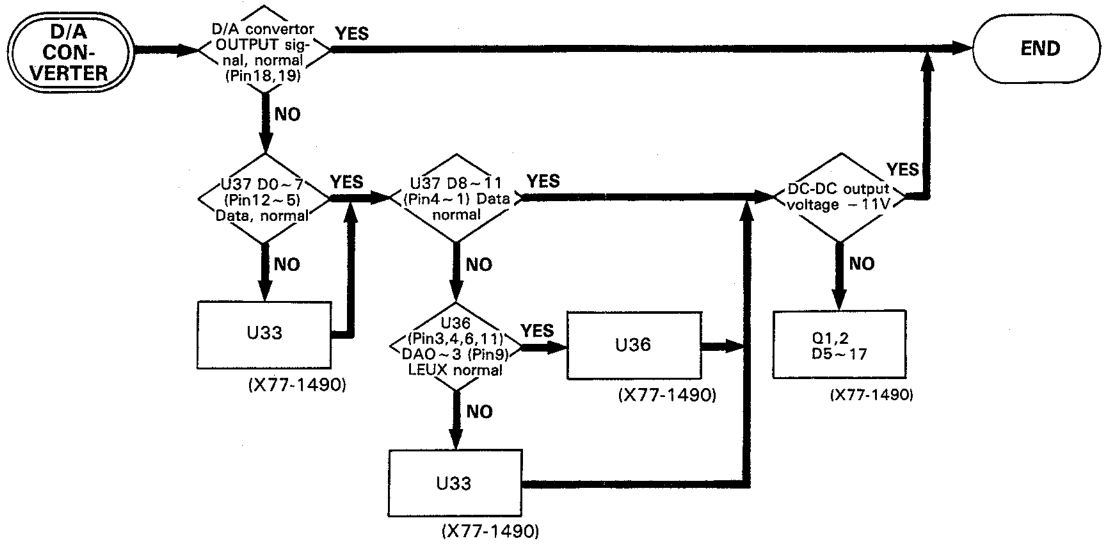
U18
Pin 17: SWD0
Pin 15: SWD1
Pin 13: SWD2
Pin 11: SWD3
Pin 8 : SWD4
Pin 6 : SWD5
Pin 4 : SWD6
Pin 2 : SWD7

U17
Pin 17: CH1 ENC+ (1ENC+)
Pin 15: CH1 ENC− (1ENC−)
Pin 13: CH2 ENC+ (2ENC+)
Pin 11: CH2 ENC− (2ENC−)
Pin 8 : SWEEP ENC+ (SENC+)
Pin 6 : SWEEP ENC− (SENC−)
Pin 4 : ENDLESS DR MOVE CHECK
Pin 2 : Ready LED ON/OFF CHECK


INTER-RUPT LATCH
Interrupt
Clock INT normal
YES
NO
1min., UZO (Pin 6) Q̄ "L"
YES
NO
U20
U20 (Pin 10) OUTPF, normal
YES
NO
DECORDER
Znsec INT normal
YES
NO
U26 Pin 3 signal, normal
YES
NO
U26
U20 (Pin 2) Q̄ "L"
YES
NO
U20
U20 (Pin 13) OUTPE, normal
YES
NO
DECORDER
DISTAT INT normal
YES
NO
U33 (Pin 89) DISTAT signal normal
YES
NO
U33
U21 (Pin 2) Q̄ "L"
YES
NO
U21
U21 (Pin 13) OUTPC, normal
YES
NO
DECORDER
SW INT normal
YES
NO
U21 (Pin 6) Q̄ "L"
YES
NO
U21
U21 (Pin 10) OUTPD, normal
YES
NO
DECORDER
1

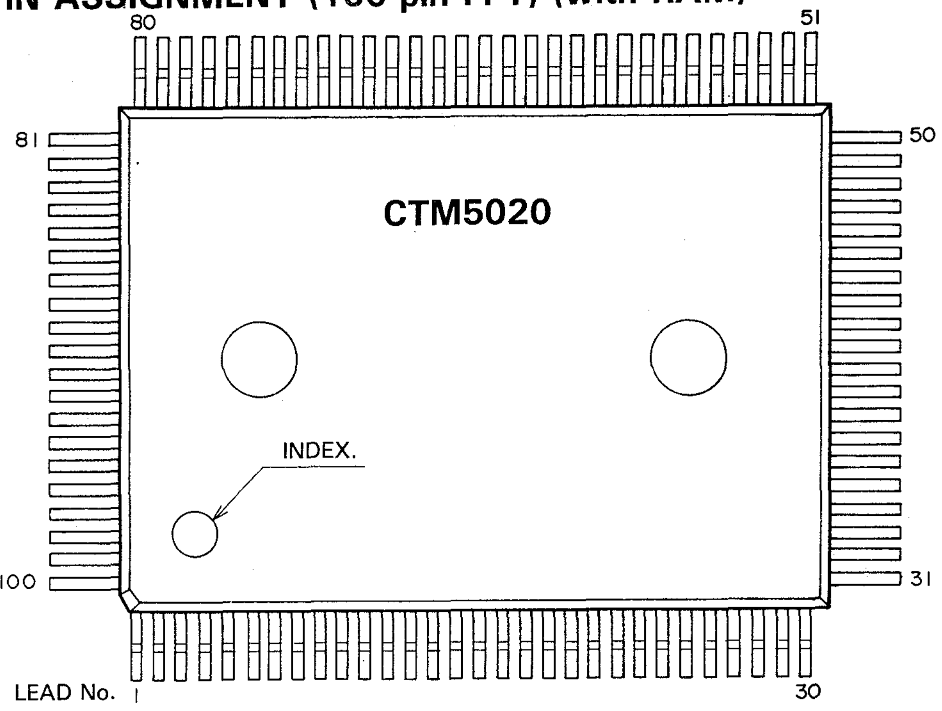

1
CH1 Rotary Encorder INST normal
YES
NO
U30 Pin 10 signal, normal
YES
NO
ROTARY ENCORDER INPORT
U22 (Pin 2) Q̄ "L"
YES
NO
U22
U22, (Pin 13) COTP9, normal
YES
NO
DECORDER
CH2 Rotary Encorder INT normal
YES
NO
U30 Pin 11 signal, normal
YES
NO
ROTARY ENCORDER INPORT
U23 (Pin 2) Q̄ "L"
YES
NO
U23
U23 (Pin 13) OUTPA, normal
YES
NO
DECORDER
Sweep Rotary Encorder INT normal
YES
NO
U30 Pin 4 signal, normal
YES
NO
ROTARY ENCORDER INPORT
U22 (Pin 6) Q̄ "L"
YES
NO
U22
U22 (Pin 10) OUTPB, normal
YES
NO
DECORDER
END

TROUBLESHOOTING


D/A CON-VERTER
D/A convertor OUTPUT signal, normal (Pin18,19)
YES
END
NO
U37 D0~7 (Pin12~5) Data, normal
YES
U37 D8~11 (Pin4~1) Data normal
YES
DC-DC output voltage −11V
YES
NO
U33
(X77-1490)
NO
U36 (Pin3,4,6,11) DAO~3 (Pin9) LEUX normal
YES
U36
(X77-1490)
NO
Q1,2 D5~17
(X77-1490)
NO
U33
(X77-1490)

TROUBLESHOOTING

CTM5020 PIN ASSIGNMENT (100-pin FPT) (with RAM)



CTM5020 PIN DESCRIPTION

Pin No.	I/O	Pin Name	Function
1	I	CONT	Selection between X-Y mode and normal mode
2	I	A13	Address bus A13
3	–	VDD	+5 V power supply
4	I	A14	Address bus A14
5	I	A15	Address bus A15
6	O	INTO	1/2 period of ROSF signal (Open pin)
7	O	VX3	Selection signal of analog switch to input the endless VR voltage
8	O	VX2	Selection signal of analog switch to input the endless VR voltage
9	O	VX1	Selection signal of analog switch to input the endless VR voltage
10	O	VX0	Selection signal of analog switch to input the endless VR voltage
11	O	DA0	Outport (8004H) D0 D/A data (LSB or D8)
12	O	DA1	Outport (8004H) D1 D/A data (D1 or D9)
13	O	DA2	Outport (8004H) D2 D/A data (D2 or D10)
14	O	DA3	Outport (8004H) D3 D/A data (D3 or MSB)
15	–	VSS	GND
16	O	DA4	Outport (8004H) D4 D/A data (D4)
17	O	DA5	Outport (8004H) D5 D/A data (D5)
18	O	DA6	Outport (8004H) D6 D/A data (D6)
19	O	DA7	Outport (8004H) D7 D/A data (D7)
20	O	DA8	Outport (8005H) D0 (Open pin)
21	O	DA9	Outport (8005H) D1 (Serial blanking control signal)
22	O	ROR	Readout monitor terminal

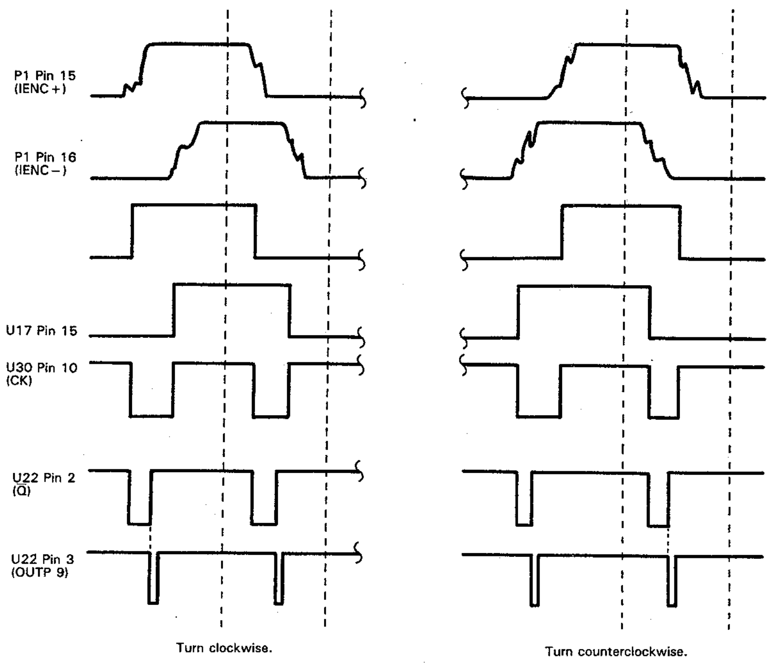
Pin No.	I/O	Pin Name	Function
23	I	ROA	Readout monitor terminal
24	O	LEVX	Outport (8005H) D7 D/A Data D8~MSB Latch signal
25	I	TCL	Test pin (UDD)
26	I	TSD0	Test pin (GND)
27	I	TSD1	Test pin (GND)
28	–	VDD	+5 V power supply
29	I	TSD2	Test pin (GND)
30	O	AX2	Selection signal of analog switch to output the cursor, H Variable, Delay Position, H Position voltage
31	O	AX1	Selection signal of analog switch to output the cursor H variable, Delay Position, H Position voltage
32	O	AX0	Selection signal of analog switch to output the cursor H variable, Delay Position, H position voltage
33	O	AX3	Selection signal of analog switch to output the cursor H variable, Delay Position, H Position voltage
34	O	HS2	Selection signal of analog switch for the readout X-axis signal
35	O	HS1	Selection signal of analog switch for the readout X-axis signal
36	O	TDIO	Test pin (VDD)
37	I	TWE	Test pin (VDD)
38	I	TCK1	Test pin (VDD)
39	I	TST1	Test pin (VDD)

Pin No.	I/O	Pin Name	Function
40	–	VSS	GND
41	I	TST2	Test pin (VDD)
42	I	TADD	Test pin (VDD)
43	I	TCK2	Test pin (VDD)
44	O	VS2	Selection signal of analog switch for the readout Y-axis signal
45	O	VS1	Selection signal of analog switch for the readout Y-axis signal
46	O	VA0	Character Y-axis DAC data
47	O	VA4	Character Y-axis DAC data
48	O	VA3	Character Y-axis DAC data
49	O	VA2	Character Y-axis DAC data
50	O	VA1	Character Y-axis DAC data
51	O	GETD	Character X-axis data latch clock
52	O	CA0	Character counter data
53	–	VDD	+5 V power supply
54	O	CA4	Character counter data
55	O	CA3	Character counter data
56	O	CA2	Character counter data
57	O	CA1	Character counter data
58	O	CD3	Character ROM address
59	O	CD2	Character ROM address
60	O	CD4	Character ROM address
61	O	CD1	Character ROM address
62	O	CD5	Character ROM address
63	O	DC4	Dot counter data
64	O	CD7	Character ROM address
65	–	VSS	GND
66	O	DC3	Dot counter data
67	O	DC2	Dot counter data
68	O	CD6	Character ROM address
69	O	DC1	Dot counter data

Pin No.	I/O	Pin Name	Function
70	O	DC0	Dot counter data
71	O	CD0	Character ROM address (Open pin)
72	I	D07	Character ROM Y-axis DAC data
73	I	D06	Character ROM Y-axis DAC data
74	I	D05	Character ROM Y-axis DAC data
75	I	D04	Character ROM Y-axis DAC data
76	I	D03	Character ROM Y-axis DAC data
77	I	SING	Terminal for SINGLE signal
78	–	VDD	+5 V power supply
79	I	R10M	10 MHz clock
80	I	10M	10 MHz clock
81	I	HLDF	Holdoff input
82	I	SGA	Sweep gate
83	I	ROSP	Readout off
84	I	ROD	Character counter reset
85	O	HLDL	Holdoff output
86	O	ROUB	Readout unblanking
87	O	ROB	Readout blanking
88	O	ROQ	Readout request
89	O	ROED	Readout end
90	–	VSS	GND
91	I	D7	Data bus D7
92	I	D5	Data bus D5
93	I	D3	Data bus D3
94	I	D1	Data bus D1
95	I	ALE	Address/Data latch
96	I	D6	Data bus D6
97	I	D4	Data bus D4
98	I	D2	Data bus D2
99	I	D0	Data bus D0
100	I	WR	Write timing signal

TROUBLESHOOTING

Rotary Encorder Timing chart (X77-1490-00)

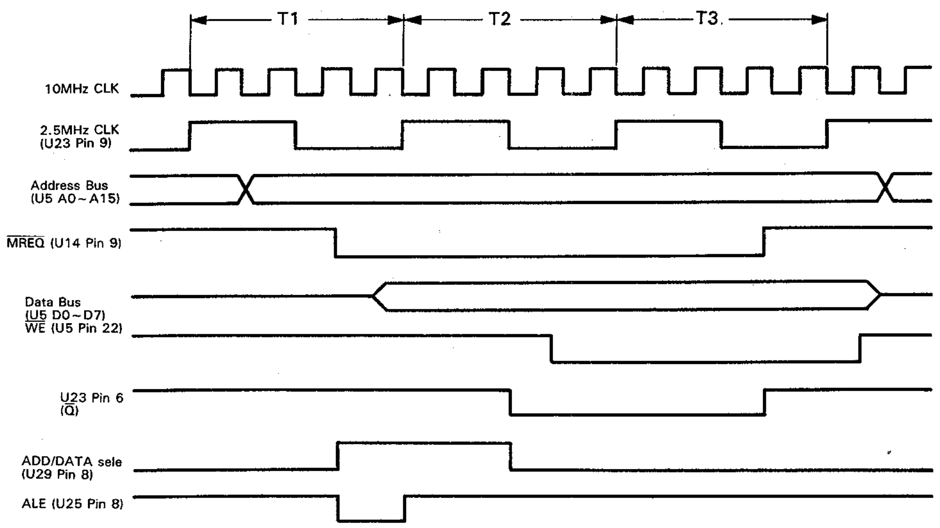


Turn clockwise.

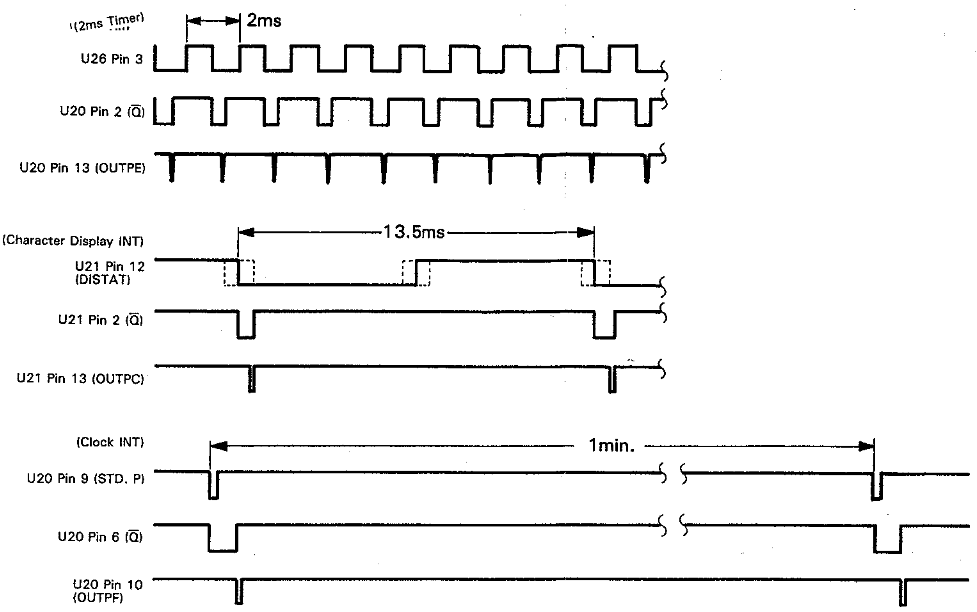
Turn counterclockwise.

The timing charts of the CH2 rotary encoder and sweep rotary encoder are also the same.

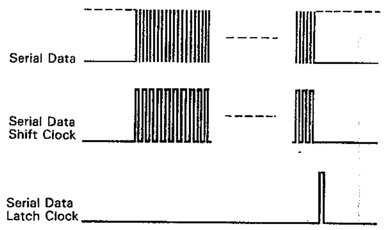
Address/Data Select Timing Chart (X77-1490-00)



Interrupt Timing Chart



Serial Transmit Timing Chart



	Panel SW SCAN	Panel LED Control	ATT UNIT Control	V UNIT Control	H UNIT Control
Serial Data	P1 Pin 4 (SD)	P1 Pin 1 (LD)	P4 Pin 9 (AD)	U16 Pin 16 (VD)	U16 Pin 19 (HD)
Serial Data shift Clock	P1 Pin 5 (SSC)	P1 Pin 2 (LSC)	P4 Pin 8 (ASC)	U9 Pin 14 (VSC)	U9 Pin 10 (HSC)
Serial Data Latch clock	P1 Pin 6 (SLC)	P1 Pin 3 (LLC)	P4 Pin 7 (ALC)	U8 Pin 11 (VLC)	U8 Pin 7 (HLC)

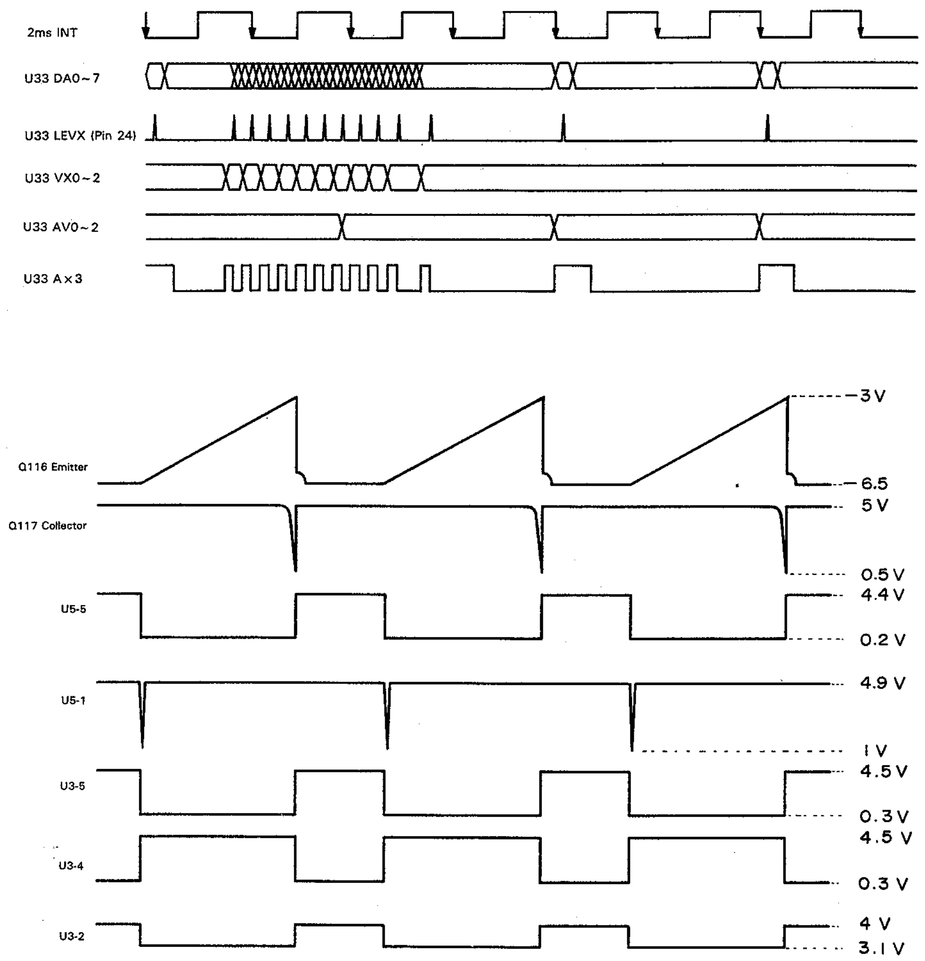
CH1 (CH2) Vertical Gain VARIABLE

V. Variable	U12 Pin 4 (2)	Display
CAL	L	Space
UNCAL	H	>

CH1 ~ CH4 Probe

Probe	U12 Pin 17,15,13,11	Display
1/1	H	Volts/div × 1 display
1/10	L	Volts/div × 10 display

Endless VR Select and Control Timing Chart



Endless VR Select

V×2	V×1	V×0	Select CH	Endless VR
L	L	L	U34 Pin 13	Δ Endless VR
L	L	H	U34 Pin 14	
L	H	L	U34 Pin 15	REF Endless VR
L	H	H	U34 Pin 12	
H	L	L	U34 Pin 1	H-Posi Endless VR
H	L	H	U34 Pin 5	
H	H	L	U34 Pin 2	H-Vari Endless VR
H	H	H	U34 Pin 4	

CONTROL Voltage Select

A×3	A×2	A×1	A×0	Select CH	Control Voltage
L	L	L	L	U41 Pin13	REF Cursor
L	L	L	H	U41 Pin 14	Δ Cursor
L	L	H	L	U41 Pin 15	A-Variable
L	L	H	H	U41 Pin 12	B-Variable
L	H	L	L	U41 Pin 1	V-Delay } (DTP)
L	H	L	H	U41 Pin 5	C-Delay }
L	H	H	L	U41 Pin 2	H-Posi
L	H	H	H	U41 Pin 4*	
H	X	X	X	All off	Inhibit

* Items marked * are not selected.
X Items marked X can be either L or H.

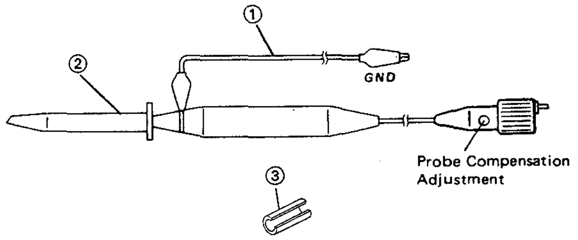
PARTS LIST

CS-6020 UNIT

Y70-1630-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	B07-0703-04	ESCUTCHEON FOR ASTIG
	B30-0925-05	LAMP ·
	B50-7670-10	INSTRUCTION MANUAL,JAPANESE
	B50-7671-10	INSTRUCTION MANUAL,ENGLISH
	E30-1644-15	BS POWER CORD
	E30-1818-05	JIS POWER CORD
	E30-1819-05	CEE POWER CORD
	E30-1820-05	UL/CSA POWER CORD
	E30-1821-05	SAA POWER CORD
	E31-0717-06	WIRE ASS'Y(INLET TO GND)
	E31-5557-05	WIRE ASS'Y(NO.14)
	E31-5558-05	WIRE ASS'Y(NO.15)
	E31-5559-05	WIRE ASS'Y(NO.24)
	E31-5560-05	WIRE ASS'Y(NO.23)
	E31-5561-05	WIRE ASS'Y(NO.22)
	E31-5562-05	WIRE ASS'Y(NO.30)
	E31-5563-05	WIRE ASS'Y(NO.7,8,9)
	E31-5564-05	WIRE ASS'Y(NO.25)
	E31-5565-05	WIRE ASS'Y(NO.26)
	E31-5566-05	WIRE ASS'Y(CAL)
	E31-5567-05	WIRE ASS'Y(NO.4)
	F05-1224-05	FUSE 1.2A(6X30MM) FOR 100/120V
	F05-8013-05	FUSE 0.8A(5X20MM) FOR 220/240V
	F05-8015-05	FUSE 0.8A(6X30MM) FOR 220/240V
	F20-0674-04	INSULATED SHEET,HIGH VOLTAGE
	H01-5889-04	CARTON BOX
	H10-2901-02	FOAMED STYRENE PAD,FRONT
	H10-2902-02	FOAMED STYRENE PAD,REAR
	H20-1727-04	VINYL COVER
	W03-2301-15	R/O PROBE, PC-31
1	A01-1194-12	CASE,TOP
2	A01-1195-22	CASE,BOTTOM
3	A13-0924-02	FRAME,RIGHT
4	A13-0925-12	FRAME,CENTER
5	A13-0926-02	FRAME,LEFT
6	A13-0927-03	FRAME,P.C.B SUPPORT
7	A13-0928-03	FRAME
8	A13-0929-03	FRAME
9	A20-2826-01	MOLDED PANEL
10	A20-2827-02	MOLDED PANEL
11	A21-1135-03	DECORATIVE PANEL
12	A21-1136-03	DECORATIVE PANEL
13	A23-1683-12	REAR PANEL
14	B11-0504-14	FILTER
15	B30-0963-05	LAMP ASS'Y,SCALE ILLUMINATION
16	B40-2909-03	NAME PLATE,MODEL
17	B41-0802-04	CAUTION LABEL,REAR PANEL
18	D19-0505-05	FLEXIBLE WIRE,FOR POWER SWITCH
19	E01-1404-05	CRT SOCKET
20	E04-0259-05	BNC RECEPTACLE
21A	E18-0365-05	AC SELECTOR WITH 6X30MM FUSE
21B	E18-0366-05	AC SELECTOR FOR 5X20MM FUSE
22	E21-0660-04	TERMINAL,CAL
23	E21-0667-05	METAL TERMINAL
24	E23-0513-05	EARTH LUG,BNC
25	E31-5568-05	FLAT CABLE
26	E31-5569-05	FLAT CABLE
27	F07-0936-04	COVER ,HANDLE LATCH
28	F10-1604-04	SHIELD,R/O UNIT
29	F10-1605-03	SHIELD,R/O UNIT
30	F10-1606-03	SHIELD,HIGH VOLTAGE UNIT
31	F11-1209-02	SHIELD,CRT:FRONT
32	F11-1210-03	SHIELD,CRT:REAR
33	F20-0673-04	INSULATED SHEET
34	G02-0606-14	SPRING,FOR HANDLE
35	J02-0089-05	RUBBER FOOT
36	J11-0508-05	CABLE CLAMP
37	J19-1656-03	HOLDER,COIL
38	J19-1657-04	WEDGE
39	J21-2906-05	GEAR,FOR HANDLE
40	J21-2907-05	RING,FOR HANDLE
41	J21-4642-04	BRACKET
42	J21-4613-04	BRACKET
43	J32-0836-04	BOSS,FOR POWER SWITCH
44	J61-0516-05	SUPPORT
45	J61-0521-05	SUPPORT
46	K01-0528-05	HANDLE,CARRYING
47	K21-0898-03	KNOB,VOLT/DIV,SWEEP TIME/DIV
48	K23-0808-03	KNOB (18 USED)
49	K27-0504-04	KNOB,PUSH:POWER
50	K27-0543-04	KNOB,PUSH(34 USED)
51	L01-9766-05	POWER TRANSFORMER
52	L39-0527-05	COIL,TRACE ROTATION
53	L76-0115-05	DELAY LINE
54	S40-1524-05	PUSH SWITCH,POWER
55	W01-0503-04	REAR RUBBER FOOT/CORD WRAP
56	X66-1050-00	PANEL UNIT
57	X68-1500-00	POWER SUPPLY UNIT
58	X68-1510-00	HIGH VOLTAGE UNIT
59	X69-1150-00	SWITCH UNIT
60	X73-1760-00	VERTICAL PREAMP UNIT
61	X74-1480-00	HORIZONTAL UNIT
62	X75-1180-00	ATT. UNIT
63	X77-1490-00	R/O UNIT
64	X77-1500-00	CONNECTION UNIT
65	X80-1100-00	FINAL UNIT
66	X81-2330-00	VOLUME UNIT
67	150XTM31	CRT
68	J59-0403-05	NYLON RIVET (ILLUMI)
69	N19-0710-05	WASHER
70	J19-1660-05	SUPPORT,FOR PCB

MODEL PC-31 (LOW CAPACITY PROBE)



ITEM	DESCRIPTION	PARTS NO.
①	Ground Wire Assembly	E30-1883-08
②	Retractable Hook Tip	E29-0540-08
③	Marker (Orange)	B42-1950-08

PARTS LIST

PANEL UNIT

X66-1050-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5197-03	PCB (UNMOUNTED)			
45	J61-0521-05	SUPPORT			
C001	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V
C002	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V
C003	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V
C004	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V
C005	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V
C006	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V
C007	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V
C008	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V
D001	MA700	DIODE			
D002	MA700	DIODE			
J031	E31-5555-05	LEAD WIRE WITH CONNECTOR			
J100	R92-0150-05	JUMPING RES.	ZERO OHM(10MM)		
J101	R92-0150-05	JUMPING RES.	ZERO OHM(10MM)		
P002	E40-7038-05	PIN CONNECTOR	26P		
Q001	2SC2785(F)	TR. SI, NPN			
Q002	2SA1175(F)	TR. SI, PNP			
Q003	2SC2785(F)	TR. SI, NPN			
Q004	2SA1175(F)	TR. SI, PNP			
R001	RN14BK2C2202F	RES. METAL FILM	22K	1%	1/6W
R002	RN14BK2C9103F	RES. METAL FILM	910K	1%	1/6W
R003	RN14BK2C9103F	RES. METAL FILM	910K	1%	1/6W
R004	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R005	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R006	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R007	RN14BK2C2202F	RES. METAL FILM	22K	1%	1/6W
R008	RN14BK2C9103F	RES. METAL FILM	910K	1%	1/6W
R009	RN14BK2C9103F	RES. METAL FILM	910K	1%	1/6W
R010	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R011	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R012	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R013	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R014	RN14BK2C1802F	RES. METAL FILM	18K	1%	1/6W
R015	RD14BB2E220J	RES. CARBON	22	5%	1/4W
U001	NJM4558D	IC, DUAL OP AMP			
VR001	R05-3514-05	VOLUME	20K B		
VR002	R05-3514-05	VOLUME	20K B		
VR003	R05-3514-05	VOLUME	20K B		
VR004	R05-3514-05	VOLUME	20K B		
VR005	R05-3514-05	VOLUME	20K B		
VR006	R05-3514-05	VOLUME	20K B		
VR007	R05-3514-05	VOLUME	20K B		
VR008	R05-3514-05	VOLUME	20K B		
VR009	R05-3514-05	VOLUME	20K B		
VR010	R05-3514-05	VOLUME	20K B		
VR011	R10-3504-05	ENDLESS VOLUME	2X10K B		
VR012	R10-3504-05	ENDLESS VOLUME	2X10K B		
VR013	R10-3504-05	ENDLESS VOLUME	2X10K B		
VR014	R10-3504-05	ENDLESS VOLUME	2X10K B		

POWER SUPPLY UNIT

X68-1500-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5227-03	PCB (UNMOUNTED)			
	N14-0626-04	NUT			
	N30-3008-41	SCREW, PAN HD	M3X8		
73	F01-0865-14	HEAT SINK			
C001	CE04W2E4R7M	CAP. ELECTRO	4.7	20%	250V
C002	CE04EW2A220M	CAP. ELECTRO	22	20%	100V
C003	CE04EW1C331M	CAP. ELECTRO	330	20%	16V
C004	CE04EW1C331M	CAP. ELECTRO	330	20%	16V
C005	CE04EW1E101M	CAP. ELECTRO	100	20%	25V
C006	CE04EW1A102M	CAP. ELECTRO	1000	20%	10V
C007	CE04W2E470M	CAP. ELECTRO	47	20%	250V
C008	CE04EW2A471M	CAP. ELECTRO	470	20%	100V
C009	C90-0973-05	CAP. ELECTRO	6800	20%	25V
C010	C90-0973-05	CAP. ELECTRO	6800	20%	25V
C011	C90-0982-05	CAP. ELECTRO	10000	20%	16V
C012	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C013	CE04EW1H331M	CAP. ELECTRO	330	20%	50V
C014	CE04EW1V471M	CAP. ELECTRO	470	20%	35V
C015	CE04EW1E101M	CAP. ELECTRO	100	20%	25V
C016	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C017	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C018	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C019	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	MTZ13JB	DIODE, ZENER	12.88V		
D004	MTZ13JB	DIODE, ZENER	12.88V		
D005	MTZ5.1JB	DIODE, ZENER	5.07V		
D006	S1VB60	DIODE			
D007	S1VB60	DIODE			
D008	S4VB40F	DIODE, BRIDGE			
D009	S4VB40F	DIODE, BRIDGE			
D010	1SR35-200A	DIODE			
D011	1SR35-200A	DIODE			
D012	MTZ24JC	DIODE, ZENER	23.72V		
D013	MTZ7.5JA	DIODE, ZENER	7.04V		
P017	E40-1173-05	PIN CONNECTOR	11P		
P018	E40-7040-05	PIN CONNECTOR	13P		
Q001	2SD1409	TR, SI, NPN			
Q002	2SC2271(D)	TR, SI, NPN			
Q003	2SD1409	TR, SI, NPN			
Q004	2SC2271(D)	TR. SI, NPN			
Q005	2SB1133(S)	TR. SI, PNP			
Q006	2SD1666(S)	TR. SI, NPN			
Q007	2SB1133(S)	TR. SI, PNP			
Q008	2SA684(Q)	TR. SI, PNP			
R001	RN14BK2C1302F	RES. METAL FILM	13K	1%	1/6W
R002	RN14BK2C1803F	RES. METAL FILM	180K	1%	1/6W
R003	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R004	RN14BK2C2002F	RES. METAL FILM	20K	1%	1/6W
R005	RN14BK2C1203F	RES. METAL FILM	120K	1%	1/6W
R006	RD14BB2C912J	RES. CARBON	9.1K	5%	1/6W
R007	RN14BK2C2002F	RES. METAL FILM	20K	1%	1/6W
R008	RN14BK2C2002F	RES. METAL FILM	20K	1%	1/6W
R009	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R010	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R011	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R012	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R013	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R014	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R015	RN14BK2C2002F	RES. METAL FILM	20K	1%	1/6W
R016	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R017	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R018	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R019	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R020	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R021	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R022	NO USE				
R023	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R024	RD14BB2C163J	RES. CARBON	16K	5%	1/6W
R025	R92-1402-05	RES. SPECIAL POWER	24	5%	2W
R026	NO USE				
R027	R92-1402-05	RES. SPECIAL POWER	24	5%	2W
R028	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R029	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R030	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R031	R92-1421-05	RES. SPECIAL POWER	7.5	5%	3W
R032	RN14BK2C1502F	RES. METAL FILM	15K	1%	1/6W
R033	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R034	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R035	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R036	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
U001	NJM4556S	IC,DUAL OP AMP			
U002	NJM4556S	IC,DUAL OP AMP			
U003	NJM4556S	IC,DUAL OP AMP			
VR001	R12-1551-05	RES. SEMI FIXED	1KB		

PARTS LIST

HIGH VOLTAGE UNIT

X68-1510-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	F01-0813-05	HEAT SINK (CONVERTER)			
	F10-1601-04	SHIELD PLATE			
	F15-0727-04	HOLDER (NEON LAMP)			
	J25-5226-03	PCB (UNMOUNTED)			
	N30-3006-41	SCREW, PAN HD	M3X6		
	W02-0458-05	HIGH VOLTAGE UNIT			
C001	CE04EW1E221M	CAP. ELECTRO	220	20%	25V
C002	CE04EW1E221M	CAP. ELECTRO	220	20%	25V
C003	CK45B1H472K	CAP. CERAMIC	4700P	10%	50V
C004	CK45FB1H222K	CAP. CERAMIC	2200P	10%	50V
C005	CC45SL2H101J	CAP. CERAMIC	100P	5%	500V
C006	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C007	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C008	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C009	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V
C010	CF92V1H224J	CAP. POLYESTER	0.22	5%	50V
C011	CF92V1H224J	CAP. POLYESTER	0.22	5%	50V
C012	CK45E3F102P	CAP. CERAMIC	1000P		3.1K
C013	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C014	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C015	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C016	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C017	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C018	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V
C019	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C020	CK45FB2H472K	CAP. CERAMIC	4700P	10%	500V
C021	CC45CH2H010C	CAP. CERAMIC	1P	0.25P	500V
C022	CC45CH2H010C	CAP. CERAMIC	1P	0.25P	500V
C023	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C024	CC45CH2H020C	CAP. CERAMIC	2P	0.25P	500V
C025	CC45CH2H010C	CAP. CERAMIC	1P	0.25P	500V
C026	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C027	CK45FB2H472K	CAP. CERAMIC	4700P	10%	500V
C031	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C032	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C033	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C034	C91-1274-05	CAP. CERAMIC	2700P	10%	3.15K
C035	CE04W2C2R2M	CAP. ELECTRO	2.2	20%	160V
C036	CE04W2C2R2M	CAP. ELECTRO	2.2	20%	160V
C037	CK45FB2H472K	CAP. CERAMIC	4700P	10%	500V
C038	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C039	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C040	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C043	CE04EW0J102M	CAP. ELECTRO	1000	20%	6.3V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SR35-200A	DIODE			
D005	1SR35-200A	DIODE			
D006	1SS83	DIODE			
D007	1SS83	DIODE			
D008	1SR35-200A	DIODE			
D009	1SR35-200A	DIODE			
D010	1SS83	DIODE			
D011	1SS132	DIODE			
D012	1SS132	DIODE			
D013	1SS83	DIODE			
L001	L40-3925-04	FERRI INDUCTOR	3.9MH		
L002	L40-1011-04	FERRI INDUCTOR	100UH		
L003	L40-1011-04	FERRI INDUCTOR	100UH		
L004	L40-1545-06	FERRI INDUCTOR	150MH		
NL001	NE-2B	NEON LAMP			
NL002	NE-2B	NEON LAMP			
NL003	NE-2B	NEON LAMP			
NL004	NE-2B	NEON LAMP			
P019	E40-1273-05	PIN CONNECTOR	12P		
P022	E40-0273-05	PIN CONNECTOR	2P		
P023	E40-0503-05	PIN CONNECTOR	5P		
P024	E40-0373-05	PIN CONNECTOR	3P		
P025	E40-0473-05	PIN CONNECTOR	4P		
P026	E40-1073-05	PIN CONNECTOR	10P		
Q001	2SD613(E)	TR. SI. NPN			
Q002	2SA1175(F)	TR. SI. PNP			
Q003	2SA1208(S,T)	TR. SI. PNP			
Q004	2SC2910(S,T)	TR. SI. NPN			
Q005	2SA1209(S,T)	TR. SI. PNP			
Q006	2SC2911(S,T)	TR. SI. NPN			
Q007	2SA1175(F)	TR. SI. PNP			
Q008	2SC3315(C)	TR. SI. NPN			
R001	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R002	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R003	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R004	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R005	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R006	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R007	R92-1128-05	RES. FIXED	9.1M	1%	1W
R008	R92-1128-05	RES. FIXED	9.1M	1%	1W
R009	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R010	R92-1034-05	RES. METAL FILM	47M	5%	1/2W
R011	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R012	RD14BB2C474J	RES. CARBON	470K	5%	1/6W
R013	R92-1034-05	RES. METAL FILM	47M	5%	1/2W
R014	RD14BB2C474J	RES. CARBON	470K	5%	1/6W
R015	RD14BB2C823J	RES. CARBON	82K	5%	1/6W
R016	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R017	RD14BB2C683J	RES. CARBON	68K	5%	1/6W
R018	RD14BB2C114J	RES. CARBON	110K	5%	1/6W
R019	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R020	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R021	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R022	RD14BB2C134J	RES. CARBON	130K	5%	1/6W
R023	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R024	RD14BB2C134J	RES. CARBON	130K	5%	1/6W
R025	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R026	RD14BB2C913J	RES. CARBON	91K	5%	1/6W
R027	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R028	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R029	RD14BB2C113J	RES. CARBON	11K	5%	1/6W
R030	RD14BB2C203J	RES. CARBON	20K	5%	1/6W
R034	R92-1050-05	RES. METAL FILM	5.1M	5%	1/2W
R035	R92-1422-05	RES. FIXED	3.9M	5%	1/2W
R036	RD14BB2C203J	RES. CARBON	20K	5%	1/6W
R037	RN14BK2E1804F	RES. METAL FILM	1.8M	1%	1/4W
R038	NO USE				
R039	RD14BB2C204J	RES. CARBON	200K	5%	1/6W
R040	RD14BB2C684J	RES. CARBON	680K	5%	1/6W
R041	RD14BB2C684J	RES. CARBON	680K	5%	1/6W
R042	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R043	RD14BB2C6R8J	RES. CARBON	6.8	5%	1/6W
R044	R92-1126-05	RES. FIXED	4.3M	5%	1/2W
R047	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R048	RD14BB2C101J	RES. CARBON	100	5%	1/6W
U001	NJM4558D	IC, DUAL OP AMP			
VR001	R12-5524-05	RES. SEMI FIXED	100K B		
VR002	R12-8501-05	RES. SEMI FIXED	2.2M B		

SWITCH UNIT

X69-1150-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5233-03	PCB (UNMOUNTED)			
D038	B30-0964-05	LED			
D039	B30-0965-05	LED			
D040	B30-0964-05	LED			
D041	B30-0965-05	LED			
D042	B30-0964-05	LED			
D043	B30-0965-05	LED			
D044	B30-0965-05	LED			
D045	1SS132	DIODE			
D046	1SS132	DIODE			
D047	1SS132	DIODE			
D048	1SS132	DIODE			
D049	1SS132	DIODE			
P001	E40-7036-05	PIN CONNECTOR	20P		
R015	R90-0652-05	RES. NETWORK	6X10K	5%	
R016	R90-0653-05	RES. NETWORK	8X10K	5%	
R017	R90-0614-05	RES. NETWORK	8X390	5%	
R018	R90-0639-05	RES. NETWORK	6X390	5%	
R019	R90-0639-05	RES. NETWORK	6X390	5%	
R020	R90-0639-05	RES. NETWORK	6X390	5%	
R021	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R022	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R023	RD14BB2C391J	RES. CARBON	390	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
S001	W02-0810-05	ROTARY ENCORDER
S002	W02-0810-05	ROTARY ENCORDER
S003	W02-0810-05	ROTARY ENCORDER
S004	S40-2525-05	SWITCH
S005	S40-2525-05	SWITCH
S006	S40-2525-05	SWITCH
S007	S40-2525-05	SWITCH
S008	S40-2525-05	SWITCH
S009	S40-2525-05	SWITCH
S010	S40-2525-05	SWITCH
S011	S40-2525-05	SWITCH
S012	S40-2525-05	SWITCH
S013	S40-2525-05	SWITCH
S014	S40-2525-05	SWITCH
S015	S40-2525-05	SWITCH
S016	S40-2525-05	SWITCH
S017	S40-2525-05	SWITCH
S018	S40-2525-05	SWITCH
S019	S40-2525-05	SWITCH
S020	S40-2525-05	SWITCH
S021	S40-2525-05	SWITCH
S022	S40-2525-05	SWITCH
S023	S40-2525-05	SWITCH
S024	S40-2525-05	SWITCH
S025	S40-2525-05	SWITCH
S026	S40-2525-05	SWITCH
S027	S40-2525-05	SWITCH
S028	S40-2525-05	SWITCH
S029	S40-2525-05	SWITCH
S030	S40-2525-05	SWITCH
S031	S40-2525-05	SWITCH
S032	S40-2525-05	SWITCH
S033	S40-2525-05	SWITCH
S034	S40-2525-05	SWITCH
S035	S40-2525-05	SWITCH
S036	S40-2525-05	SWITCH
S037	S40-2525-05	SWITCH
U002	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH
U003	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH
U004	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH
U005	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH
U006	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH
U007	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH
U008	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH
U009	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH

VERTICAL PREAMP UNIT

X73-1760-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E31-5576-05	WIRE ASS'Y(GND TO GND)			
	E31-5577-05	WIRE ASS'Y(NO.A,B,C,D)			
	J25-5228-02	PCB (UNMOUNTED)			
	J61-0408-05	WIRE WRAPPING BAND			
C001	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C002	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C003	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C004	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C005	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C006	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C007	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C008	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C009	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C019	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C020	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C021	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C022	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C023	NO USE				
C024	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C025	CQ92FM1H103K	CAP. MYLAR	0.01	10%	50V
C026	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C027	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C028	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C029	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C030	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C031	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C032	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C033	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C034	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C035	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C036	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C037	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C038	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C039	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C040	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C041	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C042	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C043	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C044	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C045	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C046	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C103	CC45FCH1H020C	CAP. CERAMIC	2P	0.25P	50V
C104	CC45FCH1H050C	CAP. CERAMIC	5P	0.25P	50V
C105	NO USE				
C106	CC45FCH1H060D	CAP. CERAMIC	6P	0.5P	50V
C107	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C108	CC45FCH1H150J	CAP. CERAMIC	15P	5%	50V
C109	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C110	CC45CH1H010C	CAP. CERAMIC	1P	0.25P	50V
C111	CC45FCH1H030C	CAP. CERAMIC	3P	0.25P	50V
C112	CC45CH1H010C	CAP. CERAMIC	1P	0.25P	50V
C113	CC45FCH1H020C	CAP. CERAMIC	2P	0.25P	50V
C114	CC45FCH1H020C	CAP. CERAMIC	2P	0.25P	50V
C203	CC45FCH1H020C	CAP. CERAMIC	2P	0.25P	50V
C204	CC45FCH1H050C	CAP. CERAMIC	5P	0.25P	50V
C205	NO USE				
C206	CC45FCH1H060D	CAP. CERAMIC	6P	0.5P	50V
C207	NO USE				
C208	CC45FCH1H150J	CAP. CERAMIC	15P	5%	50V
C209	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C210	CC45CH1H010C	CAP. CERAMIC	1P	0.25P	50V
C211	CC45FCH1H030C	CAP. CERAMIC	3P	0.25P	50V
C212	CC45CH1H010C	CAP. CERAMIC	1P	0.25P	50V
C213	CC45FCH1H020C	CAP. CERAMIC	2P	0.25P	50V
C214	CC45FCH1H020C	CAP. CERAMIC	2P	0.25P	50V
C301	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C401	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C402	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C501	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C502	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C503	CC45CH1H120J	CAP. CERAMIC	12P	5%	50V
C504	CC45CH1H120J	CAP. CERAMIC	12P	5%	50V
C505	CC45FCH1H020C	CAP. CERAMIC	2P	0.25P	50V
C506	CC45FCH1H020C	CAP. CERAMIC	2P	0.25P	50V
C509	CC45SL1H471J	CAP. CERAMIC	470P	5%	50V
C510	CC45SL1H471J	CAP. CERAMIC	470P	5%	50V
C511	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C512	NO USE				
C513	CC45FCH1H040C	CAP. CERAMIC	4P	0.25P	50V
C514	CC45FCH1H040C	CAP. CERAMIC	4P	0.25P	50V
C515	CC45FCH1H040C	CAP. CERAMIC	4P	0.25P	50V
C516	CC45FCH1H040C	CAP. CERAMIC	4P	0.25P	50V
C517	CQ92FM1H103K	CAP. MYLAR	0.01	10%	50V
C518	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C519	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C520	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C601	CC45FCH1H070D	CAP. CERAMIC	7P	0.5P	50V
C602	CC45FCH1H070D	CAP. CERAMIC	7P	0.5P	50V
C603	CC45FCH1H120J	CAP. CERAMIC	12P	5%	50V
C604	CC45FCH1H120J	CAP. CERAMIC	12P	5%	50V
C605	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C606	CC45CH1H010C	CAP. CERAMIC	1P	0.25P	50V
C607	CE04HW1E220M	CAP. ELECTRO	22	20%	25V
C608	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C609	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C610	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C611	NO USE				
C612	CC45FCH1H020C	CAP. CERAMIC	2P	0.25P	50V
C701	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C702	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C703	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C704	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C705	CC45FCH1H220J	CAP. CERAMIC	22P	5%	50V
C706	CC45FCH1H220J	CAP. CERAMIC	22P	5%	50V
C707	CQ92M1H104K	CAP. MYLAR	0.1	10%	50V
C708	NO USE				
C709	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C710	NO USE				
C711	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C714	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C715	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C716	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C720	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C721	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
C800	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C801	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C802	CC45CH1H330J	CAP. CERAMIC	33P	5%	50V
C803	CC45SL1H470J	CAP. CERAMIC	47P	5%	50V
C804	CC45SL1H470J	CAP. CERAMIC	47P	5%	50V
C805	CQ92M1H104K	CAP. MYLAR	0.1	10%	50V
C806	CQ92M1H104K	CAP. MYLAR	0.1	10%	50V
C807	CC45CH1H0R5C	CAP. CERAMIC	0.5P	0.25P	50V
C808	CC45CH1H0R5C	CAP. CERAMIC	0.5P	0.25P	50V
D101	1SS132	DIODE			
D102	1SS132	DIODE			
D103	MA700	DIODE			
D104	MA700	DIODE			
D150	MA700	DIODE			
D151	MA700	DIODE			
D152	MA700	DIODE			
D153	MA700	DIODE			
D154	MA700	DIODE			
D155	MA700	DIODE			
D201	1SS132	DIODE			
D202	1SS132	DIODE			
D203	MA700	DIODE			
D204	MA700	DIODE			
D250	MA700	DIODE			
D251	MA700	DIODE			
D252	MA700	DIODE			
D253	MA700	DIODE			
D254	MA700	DIODE			
D255	MA700	DIODE			
D501	1SS132	DIODE			
D502	1SS132	DIODE			
D503	1SS132	DIODE			
D504	1SS132	DIODE			
D505	1SS132	DIODE			
D506	1SS132	DIODE			
D507	1SS132	DIODE			
D508	1SS132	DIODE			
D509	1SS132	DIODE			
D510	MTZ10JC	DIODE, ZENER	9.95V		
D511	1SS132	DIODE			
D512	MTZ5.1JB	DIODE, ZENER	5.07V		
D601	DAP401	DIODE ARRAY			
D602	DAP401	DIODE ARRAY			
D603	1SS132	DIODE			
K101	S51-2508-05	RELAY			
K102	S51-2508-05	RELAY			
K201	S51-2508-05	RELAY			
K202	S51-2508-05	RELAY			
P005	E40-0373-05	PIN CONNECTOR	3P		
P006	E40-0373-05	PIN CONNECTOR	3P		
P007	E40-0473-05	PIN CONNECTOR	4P		
P008	E40-0473-05	PIN CONNECTOR	4P		
P009	E40-0373-05	PIN CONNECTOR	3P		
P010	E40-7039-05	PIN CONNECTOR	20P		
P011	E40-0373-05	PIN CONNECTOR	3P		
P030	E40-0273-05	PIN CONNECTOR	2P		
Q001	2SA1005(K)	TR. SI, PNP			
Q002	2SA1005(K)	TR. SI, PNP			
Q003	2SA1005(K)	TR. SI, PNP			
Q004	2SA1005(K)	TR. SI, PNP			
Q005	2SA1005(K)	TR. SI, PNP			
Q006	2SA1005(K)	TR. SI, PNP			
Q007	2SA1005(K)	TR. SI, PNP			
Q008	2SA1005(K)	TR. SI, PNP			
Q101	2SC4072	TR. SI, NPN			
Q102	2SC4072	TR. SI, NPN			
Q103	2SC3779(D)	TR. SI, NPN			
Q104	2SC3779(D)	TR. SI, NPN			
Q105	2SC3315(C)	TR. SI, NPN			
Q106	2SC3315(C)	TR. SI, NPN			
Q107	2SC3315(C)	TR. SI, NPN			
Q108	2SA1161	TR. SI, PNP			
Q109	2SA1161	TR. SI, PNP			
Q110	2SC4049	TR. SI, NPN			
Q111	2SC4049	TR. SI, NPN			
Q112	2SC3779(D)	TR. SI, NPN			
Q113	2SC3779(D)	TR. SI, NPN			
Q114	2SC3779(D)	TR. SI, NPN			
Q115	2SC3779(D)	TR. SI, NPN			

REF.NO	PARTS NO	NAME & DESCRIPTION
Q116	2SC2785(F)	TR. SI, NPN
Q117	2SC3779(D)	TR. SI, NPN
Q118	2SC3779(D)	TR. SI, NPN
Q119	2SC3779(D)	TR. SI, NPN
Q120	2SC3779(D)	TR. SI, NPN
Q201	2SC4072	TR. SI, NPN
Q202	2SC4072	TR. SI, NPN
Q203	2SC3779(D)	TR. SI, NPN
Q204	2SC3779(D)	TR. SI, NPN
Q205	2SC3315(C)	TR. SI, NPN
Q206	2SC3315(C)	TR. SI, NPN
Q207	2SC3315(C)	TR. SI, NPN
Q208	2SA1161	TR. SI, PNP
Q209	2SA1161	TR. SI, PNP
Q210	2SC4049	TR. SI, NPN
Q211	2SC4049	TR. SI, NPN
Q212	2SC3779(D)	TR. SI, NPN
Q213	2SC3779(D)	TR. SI, NPN
Q214	2SC3779(D)	TR. SI, NPN
Q215	2SC3779(D)	TR. SI, NPN
Q216	2SC2785(F)	TR. SI, NPN
Q217	2SC3779(D)	TR. SI, NPN
Q218	2SC3779(D)	TR. SI, NPN
Q219	2SC3779(D)	TR. SI, NPN
Q220	2SC3779(D)	TR. SI, NPN
Q301	2SC3779(D)	TR. SI, NPN
Q302	2SC3779(D)	TR. SI, NPN
Q303	2SC3779(D)	TR. SI, NPN
Q304	2SC3779(D)	TR. SI, NPN
Q401	2SC3779(D)	TR. SI, NPN
Q402	2SC3779(D)	TR. SI, NPN
Q403	2SC3779(D)	TR. SI, NPN
Q404	2SC3779(D)	TR. SI, NPN
Q501	2SA1206	TR. SI, PNP
Q502	2SA1206	TR. SI, PNP
Q503	2SC3315(C)	TR. SI, NPN
Q504	2SC3315(C)	TR. SI, NPN
Q505	2SA1206	TR. SI, PNP
Q506	2SA1206	TR. SI, PNP
Q507	2SC3315(C)	TR. SI, NPN
Q508	2SC3315(C)	TR. SI, NPN
Q509	2SA1206	TR. SI, PNP
Q510	2SA1206	TR. SI, PNP
Q511	2SC3315(C)	TR. SI, NPN
Q512	2SC3315(C)	TR. SI, NPN
Q513	2SA1206	TR. SI, PNP
Q514	2SA1206	TR. SI, PNP
Q515	2SC3315(C)	TR. SI, NPN
Q516	2SC3315(C)	TR. SI, NPN
Q517	NO USE	
Q518	2SC3732(L)	TR. SI, NPN
Q519	2SA1206	TR. SI, PNP
Q520	2SA1206	TR. SI, PNP
Q521	2SA1175(F)	TR. SI, PNP
Q522	2SA1175(F)	TR. SI, PNP
Q523	2SA1175(F)	TR. SI, PNP
Q524	2SC3779(D)	TR. SI, NPN
Q525	2SC3779(D)	TR. SI, NPN
Q526	2SA1206	TR. SI, PNP
Q527	2SA1206	TR. SI, PNP
Q528	2SA1161	TR. SI, PNP
Q529	2SA1161	TR. SI, PNP
Q601	2SA1206	TR. SI, PNP
Q602	2SA1206	TR. SI, PNP
Q603	2SC3779(D)	TR. SI, NPN
Q604	2SA1206	TR. SI, PNP
Q605	2SA1206	TR. SI, PNP
Q606	2SA1206	TR. SI, PNP
Q607	2SC3779(D)	TR. SI, NPN
Q608	2SA1206	TR. SI, PNP
Q609	2SA1206	TR. SI, PNP
Q610	2SA1206	TR. SI, PNP
Q611	2SC3779(D)	TR. SI, NPN
Q612	2SA1206	TR. SI, PNP
Q613	2SA1206	TR. SI, PNP
Q614	2SA1206	TR. SI, PNP
Q615	2SC3779(D)	TR. SI, NPN
Q616	2SA1206	TR. SI, PNP
Q617	2SA1161	TR. SI, PNP
Q618	2SA1161	TR. SI, PNP
Q619	2SA1175(F)	TR. SI, PNP
Q620	2SA1175(F)	TR. SI, PNP
Q621	2SC3779(D)	TR. SI, NPN
Q622	2SC3779(D)	TR. SI, NPN
Q623	2SC2785(F)	TR. SI, NPN
Q624	2SC3315(C)	TR. SI, NPN

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
Q625	2SC3315(C)	TR. SI, NPN			
Q626	2SC3315(C)	TR. SI, NPN			
Q627	2SC3315(C)	TR. SI, NPN			
Q628	2SC3315(C)	TR. SI, NPN			
Q629	2SC3315(C)	TR. SI, NPN			
Q630	2SC3315(C)	TR. SI, NPN			
Q631	2SC3315(C)	TR. SI, NPN			
Q632	2SC3779(D)	TR. SI, NPN			
Q633	2SC3779(D)	TR. SI, NPN			
R001	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R002	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R003	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R004	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R005	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R006	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R007	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R008	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R009	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R010	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R011	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R012	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R013	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R014	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R101	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R102	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R103	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R104	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R105	NO USE				
R106	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R107	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R108	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R109	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R110	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R111	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R112	RD14BB2C820J	RES. CARBON	82	5%	1/6W
R117	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R118	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R119	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R120	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R121	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R122	RD14BB2C750J	RES. CARBON	75	5%	1/6W
R123	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R124	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R125	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R126	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R127	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R128	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R129	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R130	NO USE				
R131	RN14BK2C3000F	RES. METAL FILM	300	1%	1/6W
R132	RN14BK2C3000F	RES. METAL FILM	300	1%	1/6W
R133	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R134	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R135	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R136	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R137	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R138	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R139	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R140	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R141	RN14BK2C1601F	RES. METAL FILM	1.6K	1%	1/6W
R142	RN14BK2C1601F	RES. METAL FILM	1.6K	1%	1/6W
R143	RN14BK2C3000D	RES. METAL FILM	300	0.5%	1/6W
R144	RN14BK2C3000D	RES. METAL FILM	300	0.5%	1/6W
R145	RN14BK2C1500D	RES. METAL FILM	150	0.5%	1/6W
R146	RN14BK2C1500D	RES. METAL FILM	150	0.5%	1/6W
R147	RN14BK2C3000D	RES. METAL FILM	300	0.5%	1/6W
R148	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R149	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R150	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R151	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R152	RD14BB2C680J	RES. CARBON	68	5%	1/6W
R153	RD14BB2C680J	RES. CARBON	68	5%	1/6W
R154	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R155	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R156	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R157	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R158	RN14BK2C1600F	RES. METAL FILM	160	1%	1/6W
R159	RN14BK2C1600F	RES. METAL FILM	160	1%	1/6W
R160	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R161	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R162	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R163	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R164	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R165	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R166	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R167	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R168	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R169	RN14BK2C91R0F	RES. METAL FILM	91.0	1%	1/6W
R170	RN14BK2C91R0F	RES. METAL FILM	91.0	1%	1/6W
R171	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R172	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R173	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R174	RN14BK2C4702F	RES. METAL FILM	47K	1%	1/6W
R175	RN14BK2C4702F	RES. METAL FILM	47K	1%	1/6W
R176	RN14BK2C1301F	RES. METAL FILM	1.3K	1%	1/6W
R177	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R178	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R179	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R180	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R181	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R182	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R183	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R184	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R185	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R186	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R187	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R190	RD14BB2C270J	RES. CARBON	27	5%	1/6W
R201	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R202	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R203	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R204	NO USE				
R205	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R206	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R207	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R208	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R209	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R210	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R211	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R212	RD14BB2C820J	RES. CARBON	82	5%	1/6W
R217	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R218	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R219	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R220	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R221	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R222	RD14BB2C750J	RES. CARBON	75	5%	1/6W
R223	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R224	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R225	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R226	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R227	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R228	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R229	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R230	NO USE				
R231	RN14BK2C3000F	RES. METAL FILM	300	1%	1/6W
R232	RN14BK2C3000F	RES. METAL FILM	300	1%	1/6W
R233	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R234	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R235	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R236	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R237	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R238	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R239	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R240	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R241	RN14BK2C1601F	RES. METAL FILM	1.6K	1%	1/6W
R242	RN14BK2C1601F	RES. METAL FILM	1.6K	1%	1/6W
R243	RN14BK2C3000D	RES. METAL FILM	300	0.5%	1/6W
R244	RN14BK2C3000D	RES. METAL FILM	300	0.5%	1/6W
R245	RN14BK2C1500D	RES. METAL FILM	150	0.5%	1/6W
R246	RN14BK2C1500D	RES. METAL FILM	150	0.5%	1/6W
R247	RN14BK2C3000D	RES. METAL FILM	300	0.5%	1/6W
R248	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R249	NO USE				
R250	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R251	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R252	RD14BB2C680J	RES. CARBON	68	5%	1/6W
R253	RD14BB2C680J	RES. CARBON	68	5%	1/6W
R254	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R255	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R256	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R257	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R258	RN14BK2C1600F	RES. METAL FILM	160	1%	1/6W
R259	RN14BK2C1600F	RES. METAL FILM	160	1%	1/6W
R260	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R261	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R262	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R263	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R264	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R265	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R266	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R267	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R268	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R269	RN14BK2C91R0F	RES. METAL FILM	91.0	1%	1/6W
R270	RN14BK2C91R0F	RES. METAL FILM	91.0	1%	1/6W
R271	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R272	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R273	RD14BB2C470J	RES. CARBON	47	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R274	RN14BK2C4702F	RES. METAL FILM	47K	1%	1/6W
R275	RN14BK2C4702F	RES. METAL FILM	47K	1%	1/6W
R276	RN14BK2C1301F	RES. METAL FILM	1.3K	1%	1/6W
R277	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R278	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R279	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R280	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R281	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R282	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R283	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R284	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R285	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R286	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R287	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R290	RD14BB2C270J	RES. CARBON	27	5%	1/6W
R301	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R302	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R303	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R304	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R305	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R306	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R307	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R308	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R309	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R310	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R311	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R312	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R313	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R314	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R315	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R401	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R402	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R403	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R404	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R405	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R406	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R407	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R408	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R409	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R410	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R411	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R412	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R413	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R414	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R415	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R501	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R502	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R503	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R504	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R505	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R506	RD14BB2C433J	RES. CARBON	43K	5%	1/6W
R507	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R508	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R509	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R510	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R511	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R512	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R513	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R514	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R515	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R516	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R517	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R518	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R519	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R520	RD14BB2C433J	RES. CARBON	43K	5%	1/6W
R521	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R522	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R523	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R524	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R525	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R526	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R527	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R528	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R529	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R530	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R531	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R532	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R533	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R534	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R535	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R536	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R537	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R538	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R539	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R540	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R541	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R542	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R543	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R544	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R545	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R546	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R547	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R548	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R549	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R550	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R551	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R552	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R553	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R554	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R555	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R556	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R557	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R558	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R559	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R560	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R561	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R562	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R563	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R564	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R565	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R566	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R567	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R568	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R569	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R570	RN14BK2C6200F	RES. METAL FILM	620	1%	1/6W
R571	RN14BK2C6200F	RES. METAL FILM	620	1%	1/6W
R572	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R573	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R574	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R575	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R576	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R577	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R578	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R579	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R580	RD14BB2C113J	RES. CARBON	11K	5%	1/6W
R581	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R582	RD14BB2C393J	RES. CARBON	39K	5%	1/6W
R583	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R584	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R585	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R586	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R587	RN14BK2C91R0F	RES. METAL FILM	91.0	1%	1/6W
R588	RN14BK2C91R0F	RES. METAL FILM	91.0	1%	1/6W
R589	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R590	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R591	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R592	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R593	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R594	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R595	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R596	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R597	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R598	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R599	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R600	NO USE				
R601	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R602	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R603	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R604	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R605	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R606	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R607	RN14BK2C1200F	RES. METAL FILM	120	1%	1/6W
R608	NO USE				
R609	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R610	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R611	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R612	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R613	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R614	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R615	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R616	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R617	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R618	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R619	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R620	RN14BK2C1200F	RES. METAL FILM	120	1%	1/6W
R621	NO USE				
R622	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R623	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R624	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R625	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R626	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R627	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R628	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R629	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R630	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R631	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R632	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R633	RN14BK2C1300F	RES. METAL FILM	130	1%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R634	NO USE	
R635	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R636	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R637	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R638	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W
R639	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R640	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R641	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R642	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R643	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R644	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R645	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R646	RN14BK2C1300F	RES. METAL FILM 130 1% 1/6W
R647	NO USE	
R648	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R649	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R650	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R651	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W
R652	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R653	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W
R654	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R655	R90-0657-05	RES. MULTIPLE 8X330 1%
R656	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R657	RN14BK2C7500F	RES. METAL FILM 750 1% 1/6W
R658	RN14BK2C7500F	RES. METAL FILM 750 1% 1/6W
R659	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R660	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R661	RN14BK2C2701F	RES. METAL FILM 2.7K 1% 1/6W
R662	RN14BK2C2701F	RES. METAL FILM 2.7K 1% 1/6W
R663	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R664	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R665	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R666	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R667	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R668	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R669	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R670	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R671	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R672	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R673	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R674	RN14BK2C2701F	RES. METAL FILM 2.7K 1% 1/6W
R675	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R676	E31-2170-05	JUMPING WIRE
R677	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R678	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R679	RD14BB2C622J	RES. CARBON 6.2K 5% 1/6W
R680	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R681	RN14BK2C8200F	RES. METAL FILM 820 1% 1/6W
R682	RN14BK2C1601F	RES. METAL FILM 1.6K 1% 1/6W
R683	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R684	RD14BB2C300J	RES. CARBON 30 5% 1/6W
R685	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R686	RD14BB2C111J	RES. CARBON 110 5% 1/6W
R687	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R688	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R689	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R690	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R691	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R701	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R702	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
R703	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R704	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W
R705	RN14BK2C1601F	RES. METAL FILM 1.6K 1% 1/6W
R706	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R707	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
R708	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R709	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W
R710	RN14BK2C1601F	RES. METAL FILM 1.6K 1% 1/6W
R711	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R712	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R713	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R714	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R800	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R801	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R802	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R810	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R811	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R812	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R813	RD14BB2C470J	RES. CARBON 47 5% 1/6W
TC101	C05-0469-05	CAP. TRIMMER 10P
TC201	C05-0469-05	CAP. TRIMMER 10P
TC501	C05-0469-05	CAP. TRIMMER 10P
TC502	C05-0469-05	CAP. TRIMMER 10P
TC503	C05-0469-05	CAP. TRIMMER 10P
TC504	C05-0469-05	CAP. TRIMMER 10P
TH501	SDT100	THERMISTOR
U001	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH
U002	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH
U003	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH
U004	HD74LS42P	IC,BCD TO DECIMAL DECODER
U005	SN74ALS00AN	IC,QUAD 2 INPUT NAND GATE
U006	SN74ALS112AN	IC, DUAL J-K F.F.(WITH PR&CLR)
U007	SN74ALS00AN	IC,QUAD 2 INPUT NAND GATE
U008	SN74ALS112AN	IC, DUAL J-K F.F.(WITH PR&CLR)
U009	SN74ALS00AN	IC,QUAD 2 INPUT NAND GATE
U101	NJM4558D	IC, DUAL OP AMP
U201	NJM4558D	IC, DUAL OP AMP
VR101	R12-0569-05	RES. SEMI FIXED 100B
VR102	R12-0569-05	RES. SEMI FIXED 100B
VR103	R12-2520-05	RES. SEMI FIXED 5KB
VR104	R12-3543-05	RES. SEMI FIXED 20KB
VR201	R12-0569-05	RES. SEMI FIXED 100B
VR202	R12-0569-05	RES. SEMI FIXED 100B
VR203	R12-2520-05	RES. SEMI FIXED 5KB
VR204	R12-3543-05	RES. SEMI FIXED 20KB
VR501	R12-0570-05	RES. SEMI FIXED 200B
VR502	R12-1538-05	RES. SEMI FIXED 1KB
VR503	R12-3543-05	RES. SEMI FIXED 20KB
VR504	R12-0570-05	RES. SEMI FIXED 200B
VR505	R12-1538-05	RES. SEMI FIXED 1KB
VR506	R12-3543-05	RES. SEMI FIXED 20KB
VR507	R12-0570-05	RES. SEMI FIXED 200B
VR508	R12-1538-05	RES. SEMI FIXED 1KB
VR509	R12-3543-05	RES. SEMI FIXED 20KB
VR510	R12-0570-05	RES. SEMI FIXED 200B
VR511	R12-1538-05	RES. SEMI FIXED 1KB
VR512	R12-3543-05	RES. SEMI FIXED 20KB
VR513	R12-3543-05	RES. SEMI FIXED 20KB
VR601	R12-3543-05	RES. SEMI FIXED 20KB
VR602	R12-3543-05	RES. SEMI FIXED 20KB
VR603	R12-3543-05	RES. SEMI FIXED 20KB
VR604	R12-3543-05	RES. SEMI FIXED 20KB

HORIZONTAL UNIT

X74-1480-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	E31-5572-05	WIRE ASS'Y(NO.1)
	J25-5229-02	PCB (UNMOUNTED)
	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
C001	CE04HW1H010M	CAP. ELECTRO 1 20% 50V
C002	CC45FCH1H050C	CAP. CERAMIC 5P 0.25P 50V
C003	CC45FCH1H030C	CAP. CERAMIC 3P 0.25P 50V
C004	CC45FCH1H050C	CAP. CERAMIC 5P 0.25P 50V
C005	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C006	CC45FCH1H221J	CAP. CERAMIC 220P 5% 50V
C007	CC45FCH1H200J	CAP. CERAMIC 20P 5% 50V
C008	CF92V1H333J	CAP. PLASTIC FILM 0.033 5% 50V
C009	CF92V1H684J	CAP. PLASTIC FILM 0.68 5% 50V
C010	CF92V1H684J	CAP. PLASTIC FILM 0.68 5% 50V
C011	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C012	CC45FCH1H150J	CAP. CERAMIC 15P 5% 50V
C013	CE04HW1H010M	CAP. ELECTRO 1 20% 50V
C014	CC45FCH1H030C	CAP. CERAMIC 3P 0.25P 50V
C015	CC45FCH1H150J	CAP. CERAMIC 15P 5% 50V
C016	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C017	CC45FCH1H200J	CAP. CERAMIC 20P 5% 50V
C018	CF92V1H333J	CAP. PLASTIC FILM 0.033 5% 50V
C019	CC45FCH1H221J	CAP. CERAMIC 220P 5% 50V
C020	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C021	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C022	NO USE	
C023	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C024	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C025	NO USE	
C026	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C027	CK45FF1H103Z	CAP. CERAMIC 0.01 50V

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
C101	CC45FCH1H050C	CAP. CERAMIC	5P	0.25P	50V
C102	CK45FB1H222K	CAP. CERAMIC	2200P	10%	50V
C103	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C104	CC45FCH1H050C	CAP. CERAMIC	5P	0.25P	50V
C105	CK45FB1H222K	CAP. CERAMIC	2200P	10%	50V
C106	CK45FB1H222K	CAP. CERAMIC	2200P	10%	50V
C107	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C108	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C109	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C110	CM93BD2A101J	CAP. MICA	100P	5%	100V
C111	C91-1272-05	CAP. PLASTIC FILM	1.5	5%	100V
C112	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C113	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C114	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C115	CC45FSL1H391J	CAP. CERAMIC	390P	5%	50V
C116	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C117	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C118	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C119	NO USE				
C120	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C121	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C122	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C123	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C124	CM93BD2A101J	CAP. MICA	100P	5%	100V
C125	C91-1272-05	CAP. PLASTIC FILM	1.5	5%	100V
C126	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C127	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C128	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C129	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C130	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C131	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C132	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C133	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C134	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C135	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C136	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C137	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C138	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C139	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C140	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C141	CC45FCH1H200J	CAP. CERAMIC	20P	5%	50V
C145	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C302	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C303	NO USE				
C304	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C305	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C306	C90-0987-05	CAP. ELECTRO	1000	20%	6.3V
C310	CC45FCH1H070D	CAP. CERAMIC	7P	0.5P	50V
C311	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C312	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C313	CC45FCH1H070D	CAP. CERAMIC	7P	0.5P	50V
C325	CE04EW1H2R2M	CAP. ELECTRO	2.2	20%	50V
C401	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C402	CC45FCH1H910J	CAP. CERAMIC	91P	5%	50V
C403	CC45FCH1H910J	CAP. CERAMIC	91P	5%	50V
C404	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C405	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C406	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C407	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C501	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C502	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C503	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C504	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C505	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C506	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C507	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C508	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C509	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C510	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C511	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C512	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C513	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C514	NO USE				
C515	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C516	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C517	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C518	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C519	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C528	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C529	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C530	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C531	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C532	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C533	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C534	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C535	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C551	CE04EW1A471M	CAP. ELECTRO	470	20%	10V
C552	CE04EW1C331M	CAP. ELECTRO	330	20%	16V
C553	CE04EW1C331M	CAP. ELECTRO	330	20%	16V
C554	CE04EW1A102M	CAP. ELECTRO	1000	20%	10V
C555	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C556	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C557	CQ92FM1H103K	CAP. MYLAR	0.01	10%	50V
C558	CQ92FM1H103K	CAP. MYLAR	0.01	10%	50V
C600	CC45CH1H270J	CAP. CERAMIC	27P	5%	50V
C601	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	MA700	DIODE			
D004	MA700	DIODE			
D005	MA700	DIODE			
D006	MA700	DIODE			
D007	MA700	DIODE			
D008	1SS132	DIODE			
D009	1SS132	DIODE			
D010	MA700	DIODE			
D101	MA700	DIODE			
D102	MA700	DIODE			
D103	MA700	DIODE			
D104	MA700	DIODE			
D105	MA700	DIODE			
D106	MA700	DIODE			
D107	MA700	DIODE			
D108	MA700	DIODE			
D109	MA700	DIODE			
D110	MA700	DIODE			
D111	MA700	DIODE			
D112	1SS132	DIODE			
D113	1SS132	DIODE			
D114	NO USE				
D115	MA700	DIODE			
D116	MA700	DIODE			
D117	MA700	DIODE			
D118	1SS132	DIODE			
D119	1SS132	DIODE			
D120	1SS132	DIODE			
D121	NO USE				
D122	MA700	DIODE			
D123	MA700	DIODE			
D124	1S1587	DIODE			
D125	NO USE				
D126	1S1587	DIODE			
D127	NO USE				
D128	1SS132	DIODE			
D301	1SS132	DIODE			
D302	1SS132	DIODE			
D303	1SS132	DIODE			
D304	MA700	DIODE			
D305	1SS132	DIODE			
D306	MA700	DIODE			
D307	1SS132	DIODE			
D308	1SS132	DIODE			
D309	1SS132	DIODE			
D310	MA700	DIODE			
D311	MA700	DIODE			
D312	MA700	DIODE			
D313	MA700	DIODE			
D314	MA700	DIODE			
D315	1SS132	DIODE			
D316	1SS132	DIODE			
D350	MTZ3.3JA	DIODE, ZENER	3.27V		
D351	1SS132	DIODE			
D401	1SS132	DIODE			
D402	MA700	DIODE			
K001	S51-1523-05	RELAY			
K002	S51-1523-05	RELAY			
L001	L40-1011-04	FERRI INDUCTOR	100UH		
L002	L40-2201-03	FERRI INDUCTOR	22UH		
L003	L40-2201-03	FERRI INDUCTOR	22UH		
P018	E40-7035-05	SOCKET	40P		

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
Q001	2SC3779(D)	TR. SI, NPN			
Q002	2SC3779(D)	TR. SI, NPN			
Q003	2SA1565	TR. SI, PNP			
Q004	2SC4049	TR. SI, NPN			
Q005	2SA1206	TR. SI, PNP			
Q006	2SC3779(D)	TR. SI, NPN			
Q007	2SA1206	TR. SI, PNP			
Q008	2SC2785(F)	TR. SI, NPN			
Q009	2SC4049	TR. SI, NPN			
Q010	2SC4049	TR. SI, NPN			
Q014	2SC3779(D)	TR. SI, NPN			
Q015	2SC3779(D)	TR. SI, NPN			
Q016	2SA1565	TR. SI, PNP			
Q017	2SA1206	TR. SI, PNP			
Q018	2SC3779(D)	TR. SI, NPN			
Q019	2SA1206	TR. SI, PNP			
Q020	2SC2785(F)	TR. SI, NPN			
Q101	2SC4049	TR. SI, NPN			
Q102	NO USE				
Q103	2SA1206	TR. SI, PNP			
Q104	2SC2785(F)	TR. SI, NPN			
Q105	2SC4049	TR. SI, NPN			
Q106	2SC4049	TR. SI, NPN			
Q107	2SC4049	TR. SI, NPN			
Q108	NO USE				
Q109	2SA1005(K)	TR. SI, PNP			
Q110	2SA1175(F)	TR. SI, PNP			
Q111	2SC3732(L)	TR. SI, NPN			
Q112	2SC3732(L)	TR. SI, NPN			
Q113	2SA1175(F)	TR. SI, PNP			
Q114	2SC3315(C)	TR. SI, NPN			
Q115	2SA1175(F)	TR. SI, PNP			
Q116	2SC3354(T,S)	TR. SI, NPN			
Q117	2SC3315(C)	TR. SI, NPN			
Q118	2SC2785(F)	TR. SI, NPN			
Q119	2SA1175(F)	TR. SI, PNP			
Q120	2SC2785(F)	TR. SI, NPN			
Q121	2SC3732(L)	TR. SI, NPN			
Q122	2SA1206	TR. SI, PNP			
Q123	2SC3315(C)	TR. SI, NPN			
Q124	2SA1206	TR. SI, PNP			
Q125	2SA1565	TR. SI, PNP			
Q126	2SA1206	TR. SI, PNP			
Q127	2SA1206	TR. SI, PNP			
Q128	2SA1005(K)	TR. SI, PNP			
Q129	2SA1175(F)	TR. SI, PNP			
Q130	2SC3732(L)	TR. SI, NPN			
Q131	2SC3732(L)	TR. SI, NPN			
Q132	2SA1175(F)	TR. SI, PNP			
Q133	2SC3315(C)	TR. SI, NPN			
Q134	2SC3354(T,S)	TR. SI, NPN			
Q135	2SC3315(C)	TR. SI, NPN			
Q136	2SC3732(L)	TR. SI, NPN			
Q137	2SC3732(L)	TR. SI, NPN			
Q301	2SA1175(F)	TR. SI, PNP			
Q302	2SC2785(F)	TR. SI, NPN			
Q303	2SC3315(C)	TR. SI, NPN			
Q304	2SC3315(C)	TR. SI, NPN			
Q305	2SC3315(C)	TR. SI, NPN			
Q306	2SC3315(C)	TR. SI, NPN			
Q307	2SC3315(C)	TR. SI, NPN			
Q308	2SC3315(C)	TR. SI, NPN			
Q309	2SC3315(C)	TR. SI, NPN			
Q310	2SA1565	TR. SI, PNP			
Q311	2SC3354(T,S)	TR. SI, NPN			
Q314	2SC3354(T,S)	TR. SI, NPN			
Q401	2SK583	FET, N-CHANNEL			
Q402	2SA1175(F)	TR. SI, PNP			
Q403	2SA1005(K)	TR. SI, PNP			
Q404	2SA1005(K)	TR. SI, PNP			
Q405	2SA1175(F)	TR. SI, PNP			
Q406	2SC2785(F)	TR. SI, NPN			
R001	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R002	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R003	RN14BK2C3901F	RES. METAL FILM	3.9K	1%	1/6W
R004	RN14BK2C1600F	RES. METAL FILM	160	1%	1/6W
R005	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R006	RN14BK2C6201F	RES. METAL FILM	6.2K	1%	1/6W
R007	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R008	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R009	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R010	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R011	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R012	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R013	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R014	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R015	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R016	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R017	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R018	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R019	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R020	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R021	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R022	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R023	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R024	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R025	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R026	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R027	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R028	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R029	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R033	RD14BB2C754J	RES. CARBON	750K	5%	1/6W
R034	RD14BB2C754J	RES. CARBON	750K	5%	1/6W
R035	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R036	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R037	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R038	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R039	RN14BK2C5100F	RES. METAL FILM	510	1%	1/6W
R040	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R041	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R042	RN14BK2C5100F	RES. METAL FILM	510	1%	1/6W
R043	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R044	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R045	NO USE				
R046	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R051	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R052	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R053	RN14BK2C3901F	RES. METAL FILM	3.9K	1%	1/6W
R054	RN14BK2C1600F	RES. METAL FILM	160	1%	1/6W
R055	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R056	RN14BK2C6201F	RES. METAL FILM	6.2K	1%	1/6W
R057	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R058	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R059	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R060	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R061	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R062	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R063	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R064	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R065	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R066	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R067	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R068	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R069	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R070	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R071	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R072	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R073	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R074	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R077	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R078	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R079	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R080	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R081	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R082	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R083	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R101	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R102	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R103	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R104	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R105	R90-0659-05	RES. NETWORK	4X510	5%	1/8W
R106	NO USE				
R107	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R108	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R109	R90-0660-05	RES. NETWORK	4X1K	5%	1/8W
R110	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R111	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R112	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R113	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R114	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R115	R90-0659-05	RES. NETWORK	4X510	5%	1/8W
R116	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R117	R90-0660-05	RES. NETWORK	4X1K	5%	1/8W
R118	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R119	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R120	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R121	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R122	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R123	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R124	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R125	RD14BB2C331J	RES. CARBON	330	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R126	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R127	R90-0658-05	RES. NETWORK			
R128	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R129	RN14BK2C8201F	RES. METAL FILM	8.2K	1%	1/6W
R130	RN14BK2C1601F	RES. METAL FILM	1.6K	1%	1/6W
R131	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R132	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R133	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R134	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R135	RD14BB2C241J	RES. CARBON	240	5%	1/6W
R136	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R137	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R138	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R139	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R140	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R141	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R142	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R143	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R144	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R145	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R146	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R147	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R148	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R149	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R150	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R151	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R152	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R153	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R154	RN14BK2C1302F	RES. METAL FILM	13K	1%	1/6W
R155	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R156	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R157	RD14BB2C563J	RES. CARBON	56K	5%	1/6W
R158	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R159	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R160	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R161	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R162	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R163	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R164	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R165	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R166	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R167	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R168	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R169	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R170	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R171	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R172	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R173	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R174	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R175	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R176	RD14BB2C224J	RES. CARBON	220K	5%	1/6W
R177	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R178	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R179	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R180	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R181	RN14BK2C1102F	RES. METAL FILM	11K	1%	1/6W
R182	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R183	RN14BK2C1202F	RES. METAL FILM	12K	1%	1/6W
R184	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R185	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R186	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R187	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R188	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R189	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R190	RN14BK2C2701F	RES. METAL FILM	2.7K	1%	1/6W
R191	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R192	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R193	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R194	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R195	R90-0658-05	RES. NETWORK			
R196	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R197	RN14BK2C8201F	RES. METAL FILM	8.2K	1%	1/6W
R198	RN14BK2C1601F	RES. METAL FILM	1.6K	1%	1/6W
R199	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R200	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R201	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R202	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R203	RD14BB2C241J	RES. CARBON	240	5%	1/6W
R204	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R205	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R206	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R207	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R208	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R209	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R210	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R211	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R212	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R213	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R214	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R215	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R216	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R217	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R218	RN14BK2C1302F	RES. METAL FILM	13K	1%	1/6W
R219	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R220	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R221	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R222	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R223	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R224	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R225	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R226	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R227	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R228	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R229	RD14BB2C105J	RES. CARBON	1M	5%	1/6W
R301	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R302	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R305	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R306	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R307	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R308	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R309	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R310	NO USE				
R311	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R312	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R313	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R314	RD14BB2C203J	RES. CARBON	20K	5%	1/6W
R315	RD14BB2C273J	RES. CARBON	27K	5%	1/6W
R316	RD14BB2C273J	RES. CARBON	27K	5%	1/6W
R317	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R318	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R319	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R320	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R321	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R322	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R323	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R324	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R325	RD14BB2C164J	RES. CARBON	160K	5%	1/6W
R326	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R327	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R328	RD14BB2C131J	RES. CARBON	130	5%	1/6W
R329	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R330	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R331	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R332	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R333	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R334	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R335	RN14BK2C5602F	RES. METAL FILM	56K	1%	1/6W
R336	RN14BK2C1502F	RES. METAL FILM	15K	1%	1/6W
R337	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R338	NO USE				
R339	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R340	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R341	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R342	R90-0660-05	RES. NETWORK	4X1K	5%	1/8W
R343	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R344	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R345	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R346	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R347	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R348	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R349	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R350	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R351	RN14BK2C2702F	RES. METAL FILM	27K	1%	1/6W
R352	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R353	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R354	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R355	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R356	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R357	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R358	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R359	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R360	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R361	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R362	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R363	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R364	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R365	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R366	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R367	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R368	RN14BK2C1602F	RES. METAL FILM	16K	1%	1/6W
R369	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R370	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R371	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R372	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R373	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R374	RD14BB2C912J	RES. CARBON	9.1K	5%	1/6W
R401	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R402	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R403	NO USE				

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R404	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R405	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R406	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R407	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R408	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R409	RD14BB2C273J	RES. CARBON	27K	5%	1/6W
R410	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R411	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R412	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R413	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R414	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R415	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R416	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R417	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R418	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R419	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R420	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R421	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R422	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R423	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R600	RD14BB2C393J	RES. CARBON	39K	5%	1/6W
TC101	C05-0446-05	CAP. TRIMMER	30P		
TC102	C05-0446-05	CAP. TRIMMER	30P		
TC302	C05-0458-05	CAP. TRIMMER	7P		
TC303	C05-0458-05	CAP. TRIMMER	7P		
U001	MC10H102L	IC. QUAD 2-INPUT NOR GATE			
U002	MC10H102L	IC. QUAD 2-INPUT NOR GATE			
U003	MC10H131L	IC. DUAL D-FLIP FLOP			
U004	MC10103L	IC. QUAD 2-INPUT OR GATE			
U005	SN74ALS74AN	IC. DUAL D-F.F.(WITH PR &CLR)			
U006	SN74ALS74AN	IC. DUAL D-F.F.(WITH PR &CLR)			
U007	SN74ALS74AN	IC. DUAL D-F.F.(WITH PR &CLR)			
U008	SN74ALS191N	IC.SYNC. U/D 4-BIT BINARY COUN			
U009	SN74ALS191N	IC.SYNC. U/D 4-BIT BINARY COUN			
U010	SN74ALS191N	IC.SYNC. U/D 4-BIT BINARY COUN			
U011	SN74ALS02N	IC.QUAD 2 INPUT NOR			
U012	SN74ALS32N	IC.QUAD 2 INPUT OR			
U013	SN74ALS08N	IC.QUAD 2 INPUT AND			
U014	SN74ALS32N	IC.QUAD 2 INPUT OR			
U015	SN74ALS02N	IC.QUAD 2 INPUT NOR			
U016	MC14052BCP	IC.DUAL 4-CH ANALOG MPX/DE-MPX			
U017	MC14052BCP	IC.DUAL 4-CH ANALOG MPX/DE-MPX			
U018	MC14052BCP	IC.DUAL 4-CH ANALOG MPX/DE-MPX			
U019	MC74HC4053N	IC.TRIPLE 2CH ANALOG MPX/DE-MP			
U020	NO USE				
U021	NJM072S	IC.J-FET INPUT OP AMP			
U022	NJM072S	IC.J-FET INPUT OP AMP			
U023	NO USE				
U024	NJM072S	IC.J-FET INPUT OP AMP			
U025	NJM072S	IC.J-FET INPUT OP AMP			
U026	NJM072S	IC.J-FET INPUT OP AMP			
U027	NJM072S	IC.J-FET INPUT OP AMP			
U028	HD74HC595P	IC. 8-BIT SHIFT REGISTER/LATCH			
U029	HD74HC595P	IC. 8-BIT SHIFT REGISTER/LATCH			
U030	HD74HC595P	IC. 8-BIT SHIFT REGISTER/LATCH			
U031	HD74HC595P	IC. 8-BIT SHIFT REGISTER/LATCH			
U032	HD74HC595P	IC. 8-BIT SHIFT REGISTER/LATCH			
U101	2SK332(E)	FET. N-CHANNEL			
U102	2SC3066(F)	TR. SI. NPN			
U103	2SK332(E)	FET. N-CHANNEL			
VR001	R12-3543-05	RES. SEMI FIXED 20KB			
VR002	NO USE				
VR003	R12-0571-05	RES. SEMI FIXED 500B			
VR004	R12-3543-05	RES. SEMI FIXED 20KB			
VR101	R12-1538-05	RES. SEMI FIXED 1KB			
VR102	R12-2520-05	RES. SEMI FIXED 5KB			
VR103	R12-3543-05	RES. SEMI FIXED 20KB			
VR104	R12-3543-05	RES. SEMI FIXED 20KB			
VR301	R12-1539-05	RES. SEMI FIXED 2KB			
VR302	R12-1539-05	RES. SEMI FIXED 2KB			
VR303	R12-0571-05	RES. SEMI FIXED 500B			
VR304	R12-3453-05	RES. SEMI FIXED 10KB			
VR305	R12-3453-05	RES. SEMI FIXED 10KB			
VR306	R12-3453-05	RES. SEMI FIXED 10KB			
VR307	R12-0569-05	RES. SEMI FIXED 100B			

VERTICAL ATTENUATOR UNIT

X75-1180-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5230-03	PCB (UNMOUNTED)			
74	E04-0260-05	BNC RECEPTACLE (READOUT)			
75	J21-4612-14	BRACKET.FOR BNC			
76	J30-0623-04	SPACER			
C001	CE04EW1C471M	CAP. ELECTRO	470	20%	16V
C002	CE04EW1C471M	CAP. ELECTRO	470	20%	16V
C003	CE04EW1A221M	CAP. ELECTRO	220	20%	10V
C004	CE04EW1A221M	CAP. ELECTRO	220	20%	10V
C005	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C006	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C007	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C008	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C009	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C010	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C011	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C012	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C013	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C014	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C015	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C016	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C017	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C018	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C019	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C020	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C101	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C102	NO USE				
C103	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C104	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C105	NO USE				
C106	CC45FCH1H330J	CAP. CERAMIC	33P	5%	50V
C107	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C201	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C202	NO USE				
C203	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C204	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C205	NO USE				
C206	CC45FCH1H330J	CAP. CERAMIC	33P	5%	50V
C207	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C301	CC45CH2H050C	CAP. CERAMIC	5P	0.25P	500V
C302	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C303	NO USE				
C304	CC45FCH1H030C	CAP. CERAMIC	3P	0.25P	50V
C305	CC45CH2H080D	CAP. CERAMIC	8P	0.5P	500V
C306	NO USE				
C307	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C350	CC45CH1H180J	CAP. CERAMIC	18P	5%	50V
C351	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
C401	CC45CH2H050C	CAP. CERAMIC	5P	0.25P	500V
C402	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C403	NO USE				
C404	CC45FCH1H030C	CAP. CERAMIC	3P	0.25P	50V
C405	CC45CH2H080D	CAP. CERAMIC	8P	0.5P	500V
C406	NO USE				
C407	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C450	CC45CH1H180J	CAP. CERAMIC	18P	5%	50V
C451	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D101	1SS132	DIODE			
D102	1SS132	DIODE			
D201	1SS132	DIODE			
D202	1SS132	DIODE			
D301	1SS132	DIODE			
D302	1SS132	DIODE			
D303	1SS135	DIODE			
D401	1SS132	DIODE			
D402	1SS132	DIODE			
D403	1SS135	DIODE			
JW005	E31-5578-05	LEAD WIRE WITH CONNECTOR			
JW006	E31-5579-05	LEAD WIRE WITH CONNECTOR			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
K301	S51-2508-05	RELAY			
K401	S51-2508-05	RELAY			
L001	L40-1011-03	FERRI INDUCTOR	100UH		
P004	E40-0973-05	PIN CONNECTOR	9P		
P007	E40-0473-05	PIN CONNECTOR	4P		
P008	E40-0473-05	PIN CONNECTOR	4P		
P009	E40-0373-05	PIN CONNECTOR	3P		
Q001	2SA1565	TR. SI, PNP			
Q002	2SA1565	TR. SI, PNP			
Q101	2SC3354(T,S)	TR. SI, NPN			
Q102	2SC3354(T,S)	TR. SI, NPN			
Q201	2SC3354(T,S)	TR. SI, NPN			
Q202	2SC3354(T,S)	TR. SI, NPN			
Q301	2SK241(GR)	FET, N-CHANNEL			
Q302	2SK241(GR)	FET, N-CHANNEL			
Q303	2SC3354(T,S)	TR. SI, NPN			
Q304	2SC3779(D)	TR. SI, NPN			
Q305	2SC3779(D)	TR. SI, NPN			
Q306	2SC3354(T,S)	TR. SI, NPN			
Q401	2SK241(GR)	FET, N-CHANNEL			
Q402	2SK241(GR)	FET, N-CHANNEL			
Q403	2SC3354(T,S)	TR. SI, NPN			
Q404	2SC3779(D)	TR. SI, NPN			
Q405	2SC3779(D)	TR. SI, NPN			
Q406	2SC3354(T,S)	TR. SI, NPN			
R001	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R002	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R003	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R004	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R005	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R006	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R007	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R008	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R009	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R101	RN14BK2E1004D	RES. METAL FILM	1M	0.5%	1/4W
R102	RD14BB2C824J	RES. CARBON	820K	5%	1/6W
R103	RN14BK2C62R0F	RES. METAL FILM	62.0	1%	1/6W
R104	RN14BK2C62R0F	RES. METAL FILM	62.0	1%	1/6W
R105	R92-1431-05	RES. TEMP. COEFF.	330	5%	1/6W
R106	RN14BK2C5100F	RES. METAL FILM	510	1%	1/6W
R107	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R108	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R109	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R110	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R111	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R112	NO USE				
R113	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R114	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R115	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R116	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R117	RN14BK2C7501F	RES. METAL FILM	7.5K	1%	1/6W
R118	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R119	RN14BK2C7501F	RES. METAL FILM	7.5K	1%	1/6W
R120	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R121	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R122	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R123	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R124	NO USE				
R125	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R126	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R127	RN14BK2C3000F	RES. METAL FILM	300	1%	1/6W
R128	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R150	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R201	RN14BK2E1004D	RES. METAL FILM	1M	0.5%	1/4W
R202	RD14BB2C824J	RES. CARBON	820K	5%	1/6W
R203	RN14BK2C62R0F	RES. METAL FILM	62.0	1%	1/6W
R204	RN14BK2C62R0F	RES. METAL FILM	62.0	1%	1/6W
R205	R92-1431-05	RES. TEMP. COEFF.	330	5%	1/6W
R206	RN14BK2C5100F	RES. METAL FILM	510	1%	1/6W
R207	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R208	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R209	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R210	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R211	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R212	NO USE				
R213	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R214	RN14BK2C4301F	RES. METAL FILM	4.3K	1%	1/6W
R215	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R216	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R217	RN14BK2C7501F	RES. METAL FILM	7.5K	1%	1/6W
R218	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R219	RN14BK2C7501F	RES. METAL FILM	7.5K	1%	1/6W
R220	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R221	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R222	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R223	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R224	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R225	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R226	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R227	RN14BK2C3000F	RES. METAL FILM	300	1%	1/6W
R228	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R250	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R301	RD14BB2E330J	RES. CARBON	33	5%	1/4W
R302	RD14BB2C560J	RES. CARBON	56	5%	1/6W
R303	R92-1433-05	RES. METAL FILM	800K	0.5%	1/2W
R304	R92-1432-05	RES. METAL FILM	250K	0.5%	1/2W
R305	RD14BB2C240J	RES. CARBON	24	5%	1/6W
R306	RN14BK2E1004D	RES. METAL FILM	1M	0.5%	1/4W
R307	RD14BB2C684J	RES. CARBON	680K	5%	1/6W
R308	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R309	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R310	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R311	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R312	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R313	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R314	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R315	RN14BK2C3901F	RES. METAL FILM	3.9K	1%	1/6W
R316	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R317	NO USE				
R318	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R319	RD14BB2C820J	RES. CARBON	82	5%	1/6W
R320	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R350	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R401	RD14BB2E330J	RES. CARBON	33	5%	1/4W
R402	RD14BB2C560J	RES. CARBON	56	5%	1/6W
R403	R92-1433-05	RES. METAL FILM	800K	0.5%	1/2W
R404	R92-1432-05	RES. METAL FILM	250K	0.5%	1/2W
R405	RD14BB2C240J	RES. CARBON	24	5%	1/6W
R406	RN14BK2E1004D	RES. METAL FILM	1M	0.5%	1/4W
R407	RD14BB2C684J	RES. CARBON	680K	5%	1/6W
R408	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R409	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R410	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R411	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R412	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R413	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R414	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R415	RN14BK2C3901F	RES. METAL FILM	3.9K	1%	1/6W
R416	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R417	NO USE				
R418	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R419	RD14BB2C820J	RES. CARBON	82	5%	1/6W
R420	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R450	RD14BB2C221J	RES. CARBON	220	5%	1/6W
S101	S02-4511-15	ATTENUATOR UNIT			
S201	S02-4511-15	ATTENUATOR UNIT			
TC101	C05-0459-05	CAP. TRIMMER	10P		
TC201	C05-0459-05	CAP. TRIMMER	10P		
TC301	C05-0031-15	CAP. TRIMMER	10P		
TC302	C05-0031-15	CAP. TRIMMER	10P		
TC401	C05-0031-15	CAP. TRIMMER	10P		
TC402	C05-0031-15	CAP. TRIMMER	10P		
U001	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH			
U002	HD74HC595P	IC, 8-BIT SHIFT REGISTER/LATCH			
U101	DN1901	FET, DUAL, N-CHANNEL			
U102	UPA101G	IC, NPN TRANSISTOR ARRAY			
U201	DN1901	FET, DUAL, N-CHANNEL			
U202	UPA101G	IC, NPN TRANSISTOR ARRAY			
VR101	R12-3543-05	RES. SEMI FIXED	20KB		
VR201	R12-3543-05	RES. SEMI FIXED	20KB		

PARTS LIST

R/O UNIT

X77-1490-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5231-02	PCB (UNMOUNTED)			
	W09-0408-05	BATTERY.CR2354-1HF			
C001	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C002	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C003	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C004	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C005	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C006	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C007	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C008	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C009	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C010	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C011	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C012	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C013	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C014	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C015	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C016	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C017	CC45FCH1H220J	CAP. CERAMIC	22P	5%	50V
C018	CC45FCH1H220J	CAP. CERAMIC	22P	5%	50V
C019	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C020	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C021	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C022	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C023	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C024	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C025	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C026	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C027	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C028	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C029	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C030	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C031	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C032	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C033	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C034	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C035	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C036	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C037	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C038	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C039	CE04EW1C331M	CAP. ELECTRO	330	20%	16V
C040	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C041	CE04EW1E470M	CAP. ELECTRO	47	20%	25V
C042	CC45FSL1H471J	CAP. CERAMIC	470P	5%	50V
C043	CE04EW1A471M	CAP. ELECTRO	470	20%	10V
C044	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C045	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C046	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C047	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C048	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C049	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C050	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C051	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C052	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C053	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C054	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C055	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C056	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C057	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C058	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C059	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C060	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C061	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C062	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C063	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C064	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C065	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C066	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C067	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C068	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C069	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C070	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C071	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C072	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C073	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C074	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C075	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C076	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C077	CE04EW1C471M	CAP. ELECTRO	470	20%	16V
C078	CE04EW1C471M	CAP. ELECTRO	470	20%	16V
C079	C91-1273-05	CAP. NETWORK	6X0.01U		50V
C080	CE04EW1A102M	CAP. ELECTRO	1000	20%	10V
C081	NO USE				
C082	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C086	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C087	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V

REF.NO	PARTS NO	NAME & DESCRIPTION			
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SS132	DIODE			
D005	MTZ12JC	DIODE ZENER	12.05V		
D006	1SS132	DIODE			
D007	1SS132	DIODE			
L001	L40-1011-03	FERRI INDUCTOR	100UH		
L002	L40-1021-03	FERRI INDUCTOR	1MH		
L003	L40-1092-03	FERRI INDUCTOR	1UH		
L004	L40-1011-03	FERRI INDUCTOR	100UH		
P001	E40-7036-05	PIN CONNECTOR	20P		
P002	E40-7037-05	SOCKET	26P		
P003	E40-7035-05	SOCKET	40P		
P004	E40-0973-05	PIN CONNECTOR	9P		
Q001	2SA1175(F)	TR. SI, PNP			
Q002	2SC1384(R,S)	TR. SI, NPN			
R001	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R002	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R003	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R004	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R005	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R006	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R007	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R008	NO USE				
R009	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R010	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R011	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R012	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R013	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R014	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R015	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R016	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R017	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R018	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R019	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R020	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R021	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R022	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R023	RD14BB2C474J	RES. CARBON	470K	5%	1/6W
R024	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R025	RN14BK2C9100F	RES. METAL FILM	910	1%	1/6W
R026	RN14BK2C3302F	RES. METAL FILM	33K	1%	1/6W
R027	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R028	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R029	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R030	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R031	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R032	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R033	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R034	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R035	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R036	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R037	RN14BK2C2400F	RES. METAL FILM	240	1%	1/6W
R038	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R039	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R040	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R041	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R042	RN14BK2C2400F	RES. METAL FILM	240	1%	1/6W
R043	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R044	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R045	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R046	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R047	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R048	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R049	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R050	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R051	RD14BB2C134J	RES. CARBON	130K	5%	1/6W
R052	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R053	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R054	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R055	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R056	E31-2170-05	JUMPING WIRE			
R057	NO USE				
R058	R90-0662-05	RES. NETWORK			
R059	R90-0661-05	RES. NETWORK	4X100K		
R060	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R061	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R062	R90-0663-05	RES. NETWORK	8X1M		
R063	NO USE				
R064	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R065	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R066	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R067	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R068	NO USE				

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R069	RD14BB2C103J	RES: CARBON 10K 5% 1/6W
R070	RD14BB2C162J	RES. CARBON 1.6K 5% 1/6W
R071	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R072	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R073	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R074	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R075	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R076	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R077	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R078	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R079	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R080	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W
R081	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W
R082	RD14BB2C622J	RES. CARBON 6.2K 5% 1/6W
R083	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W
R128	E31-2170-05	JUMPING WIRE
U001	LC3517BML-15	IC,2048X8 STATIC RAM
U001	MB8416-20LPF	IC,2048X8 STATIC RAM
U002	MBM27C128*S	IC,16384X8 EPROM
U003	MSM6242BGS-VK	IC,REAL TIME CLOCK
U004	PST518B	IC,RESET
U005	LH0080A	IC,CPU
U006	DTM-5010	IC, GATE ARRAY
U007	HD74LS138FP	IC,3-TO-8 DEMULTIPLEXER
U008	HD74HC238FP	IC,3-TO-8 LINE DECODER
U009	HD74HC238FP	IC,3-TO-8 LINE DECODER
U010	HD74HC107FP	IC,DUAL J-K FLIP-FLOP
U011	HD74LS04FP	IC,HEX INVERTERS
U012	HD74LS244FP	IC,OCTAL 3-STATE BUS BUFFER
U013	HD74LS244FP	IC,OCTAL 3-STATE BUS BUFFER
U014	HD74LS04FP	IC,HEX INVERTERS
U015	HD74LS30FP	IC,8-INPUT NAND
U016	HD74LS374FP	IC,OCTAL 3-STATE D-FF
U017	HD74LS244FP	IC,OCTAL 3-STATE BUS BUFFER
U018	HD74LS244FP	IC,OCTAL 3-STATE BUS BUFFER
U019	HD14066BFP	IC,QUAD BILATERAL SWITCH
U020	HD74LS107AFP	IC,QUAD JK-FF WITH CLEAR
U021	HD74LS107AFP	IC,QUAD JK-FF WITH CLEAR
U022	HD74LS107AFP	IC,QUAD JK-FF WITH CLEAR
U023	HD74LS107AFP	IC,QUAD JK-FF WITH CLEAR
U024	HD74LS30FP	IC,8-INPUT NAND
U025	HD74LS11FP	IC,TRIPLE 3-INPUT AND
U026	NJM555M	IC,TIMER
U027	HD74LS157FP	IC,2 TO 1 DATA SELECTORS
U028	HD74LS157FP	IC,2 TO 1 DATA SELECTORS
U029	HD74HC08FP	IC,QUAD 2-INPUT AND GATE
U030	HD74HC7266FP	IC,QUAD 2-INPUT NOR GATE
U031	HD74HC08FP	IC,QUAD 2-INPUT AND GATE
U032	MBM27C64*U	IC,8192X8 EPROM
U033	CTM5020	IC,GATE ARRAY (R/O CONTROLLER)
U034	HD14051BFP	IC,8-CH ANALOG MPX/DE-MPX
U035	NJM311M	IC,VOLTAGE COMPARATOR
U036	HD74HC174FP	IC,HEX D-TYPE FLIP-FLOP
U037	AM6012DC	IC,12-BIT D/A CONVERTER
U038	HD74HC564FP	IC,OCTAL D-TYPE FLIP-FLOP
U039	HD74HC244FP	IC,OCTAL BUS BUFFER
U040	HD14052BFP	IC,DUAL 4-CH ANALOG MPX/DE-MPX
U041	HD14051BFP	IC,8-CH ANALOG MPX/DE-MPX
U042	DAC0808LCN	IC,8-BIT D/A CONVERTER
U043	HD14052BFP	IC,DUAL 4-CH ANALOG MPX/DE-MPX
U044	NJM072M	IC,DUAL J-FET INPUT OP AMP
U045	NJM072M	IC,DUAL J-FET INPUT OP AMP
U046	NJM072M	IC,DUAL J-FET INPUT OP AMP
U047	NJM072M	IC,DUAL J-FET INPUT OP AMP
X001	L78-0107-05	CERAMIC RESONATOR (10MHZ)
X002	L77-1229-05	CRYSTAL (SUB L77-1025-05)

CONNECTION UNIT

X77-1500-00

REF.NO	PARTS NO	NAME & DESCRIPTION
P003	E40-7034-05	PIN CONNECTOR 40P
P010	E40-7036-05	PIN CONNECTOR 20P
P011	NO USE	
P012	E31-5551-05	LEAD WIRE WITH CONNECTOR 10P
P013	E31-5550-05	LEAD WIRE WITH CONNECTOR 6P
P017	E31-5552-05	LEAD WIRE WITH CONNECTOR 11P
P018	E40-7034-05	PIN CONNECTOR 40P
P019	E31-5553-05	LEAD WIRE WITH CONNECTOR 12P

FINAL AMP UNIT

X80-1100-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	J25-5196-03	PCB (UNMOUNTED)
71	F01-0866-04	HEAT SINK
72	F02-0502-04	HEAT SINK
C001	CK45FB1H102K	CAP. CERAMIC 1000P 10% 50V
C002	C91-1275-05	CAP. ELECTRO 0.033F 5.5V
C003	C91-1275-05	CAP. ELECTRO 0.033F 5.5V
C004	CQ92FM1H472K	CAP. MYLAR 4700P 10% 50V
C005	CE04HW1H010M	CAP. ELECTRO 1 20% 50V
C006	CC45FCH1H330J	CAP. CERAMIC 33P 5% 50V
C007	CC45FCH1H080D	CAP. CERAMIC 8P 0.5P 50V
C008	NO USE	
C009	CC45FCH1H150J	CAP. CERAMIC 15P 5% 50V
C010	CC45FCH1H390J	CAP. CERAMIC 39P 5% 50V
C011	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C012	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C013	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C014	CC45FSL1H561J	CAP. CERAMIC 560P 5% 50V
C015	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C103	CC45FCH1H020C	CAP. CERAMIC 2P 0.25P 50V
C104	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C105	CK45FB2H472K	CAP. CERAMIC 4700P 10% 500V
C108	CC45FCH1H070D	CAP. CERAMIC 7P 0.5P 50V
C109	CC45CH2H010C	CAP. CERAMIC 1P 0.25P 500V
C110	CC45CH2H010C	CAP. CERAMIC 1P 0.25P 500V
C111	CF93AN2E103K	CAP. METAL FILM 0.01 10% 250V
C112	CF93AN2E103K	CAP. METAL FILM 0.01 10% 250V
C113	CF93AN2E104K	CAP. METAL FILM 0.1 10% 250V
C114	CF93AN2E104K	CAP. METAL FILM 0.1 10% 250V
C115	CC45FCH1H040C	
C116	CE04HW1E220M	CAP. ELECTRO 22 20% 25V
C301	CE04EW1C331M	CAP. ELECTRO 330 20% 16V
C302	CE04EW1C331M	CAP. ELECTRO 330 20% 16V
C303	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C304	CE04EW2A220M	CAP. ELECTRO 22 20% 100V
C305	CE04W2E4R7M	CAP. ELECTRO 4.7 20% 250V
C306	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C307	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C308	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C309	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C310	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C311	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C312	CK45FB2H472K	CAP. CERAMIC 4700P 10% 500V
C313	CK45FB2H472K	CAP. CERAMIC 4700P 10% 500V
C314	CK45FB2H472K	CAP. CERAMIC 4700P 10% 500V
C501	CQ92M1H102K	CAP. MYLAR 1000P 10% 50V
D001	1SS132	DIODE
D002	1SS132	DIODE
D101	TLR112	LED,RED
D102	MA700	DIODE
D105	MA700	DIODE
D106	TLR112	LED,RED
D107	1SS132	DIODE
D108	1SS132	DIODE
D201	1SS132	DIODE
D202	1SS132	DIODE
L001	L33-0806-05	CHOKE COIL (0.52UH)
L002	L33-0806-05	CHOKE COIL (0.52UH)
L003	L40-2282-70	FERRI INDUCTOR 0.22UH
L004	L40-2282-70	FERRI INDUCTOR 0.22UH
L005	L40-2202-70	FERRI INDUCTOR 22UH
P011	E40-0373-05	PIN CONNECTOR 3P
P012	E40-1073-05	PIN CONNECTOR 10P
P013	E40-0673-05	PIN CONNECTOR 6P
P014	E40-0373-05	PIN CONNECTOR 3P
P015	E40-0373-05	PIN CONNECTOR 3P
Q001	2SC3779(D)	TR. SI. NPN
Q002	2SC3779(D)	TR. SI. NPN
Q003	2SC3779(D)	TR. SI. NPN
Q004	2SC3779(D)	TR. SI. NPN
Q005	2SA1161	TR. SI. PNP
Q006	2SA1161	TR. SI. PNP
Q007	2SC3779(D)	TR. SI. NPN
Q008	2SC3779(D)	TR. SI. NPN
Q009	2SC3779(D)	TR. SI. NPN
Q010	2SC3779(D)	TR. SI. NPN

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
Q011	2SC3779(D)	TR. SI. NPN			
Q012	2SC3779(D)	TR. SI. NPN			
Q013	2SC1164(D)*S	TR. SI. NPN			
Q014	2SC1164(D)*S	TR. SI. NPN			
Q101	2SA1005(K)	TR. SI. PNP			
Q102	2SA1005(K)	TR. SI. PNP			
Q103	2SC3315(C)	TR. SI. NPN			
Q104	2SC3315(C)	TR. SI. NPN			
Q105	2SA1005(K)	TR. SI. PNP			
Q106	2SA1005(K)	TR. SI. PNP			
Q107	2SA1005(K)	TR. SI. PNP			
Q108	2SA1005(K)	TR. SI. PNP			
Q109	2SC3354(T,S)	TR. SI. NPN			
Q110	2SC3354(T,S)	TR. SI. NPN			
Q111	2SA1206	TR. SI. PNP			
Q112	2SC3354(T,S)	TR. SI. NPN			
Q113	2SC3354(T,S)	TR. SI. NPN			
Q114	2SC3600(E,F)	TR. SI. NPN			
Q115	2SC3600(E,F)	TR. SI. NPN			
Q116	2SA1406(E,F)	TR. SI. PNP			
Q117	2SA1406(E,F)	TR. SI. PNP			
Q201	2SC3315(C)	TR. SI. NPN			
Q202	2SC3315(C)	TR. SI. NPN			
Q203	2SC3354(T,S)	TR. SI. NPN			
Q204	2SC3354(T,S)	TR. SI. NPN			
Q205	2SC2785(F)	TR. SI. NPN			
Q206	2SC3315(C)	TR. SI. NPN			
Q207	2SC3315(C)	TR. SI. NPN			
Q208	2SC3354(T,S)	TR. SI. NPN			
Q209	2SC3354(T,S)	TR. SI. NPN			
Q210	2SC2785(F)	TR. SI. NPN			
R001	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R002	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R003	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R004	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R005	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R006	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R007	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R008	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R009	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R010	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R011	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R012	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R013	RD14BB2C303J	RES. CARBON	30K	5%	1/6W
R014	RD14BB2C753J	RES. CARBON	75K	5%	1/6W
R015	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R016	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R017	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R018	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R019	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R020	RN14BK2C3000F	RES. METAL FILM	300	1%	1/6W
R021	RN14BK2C3000F	RES. METAL FILM	300	1%	1/6W
R022	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R023	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R024	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R025	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R026	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R027	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R028	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R029	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R030	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R031	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R032	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R033	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R034	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R035	RN14BK2E82R0F	RES. METAL FILM	82.0	1%	1/4W
R036	RN14BK2E82R0F	RES. METAL FILM	82.0	1%	1/4W
R037	RN14BK2C3600F	RES. METAL FILM	360	1%	1/6W
R038	NO USE				
R039	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R040	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R041	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R042	RD14BB2C680J	RES. CARBON	68	5%	1/6W
R043	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R044	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R045	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R046	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R047	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R048	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R049	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R050	R92-1420-05	RES. METAL FILM	510	5%	7W
R051	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R052	R92-1420-05	RES. METAL FILM	510	5%	7W
R053	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R054	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R055	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R056	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R059	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R101	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R102	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R103	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R104	RN14BK2C4300F	RES. METAL FILM	430	1%	1/6W
R105	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R106	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R107	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R108	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R109	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R110	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R111	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R112	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R113	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R114	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R115	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R116	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R117	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R118	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R119	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R120	RN14BK2C3901F	RES. METAL FILM	3.9K	1%	1/6W
R121	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R122	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R123	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R124	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R125	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R126	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R127	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R128	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R129	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R130	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R131	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R132	RN14BK2C1301F	RES. METAL FILM	1.3K	1%	1/6W
R133	RN14BK2C1301F	RES. METAL FILM	1.3K	1%	1/6W
R134	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R135	NO USE				
R136	RD14BB2C514J	RES. CARBON	510K	5%	1/6W
R137	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R138	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R139	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R140	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R141	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R142	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R143	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R144	RN14BK2E2002F	RES. METAL FILM	20K	1%	1/4W
R145	RN14BK2E2002F	RES. METAL FILM	20K	1%	1/4W
R146	R92-1434-05	RES. SPECIAL POWER	47K	5%	1/2W
R147	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R148	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R149	RN14BK2C4702F	RES. METAL FILM	47K	1%	1/6W
R150	RN14BK2C4702F	RES. METAL FILM	47K	1%	1/6W
R151	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R152	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R153	RN14BK2E2002F	RES. METAL FILM	20K	1%	1/4W
R154	RN14BK2E2002F	RES. METAL FILM	20K	1%	1/4W
R155	R92-1434-05	RES. SPECIAL POWER	47K	5%	1/2W
R156	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R157	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R158	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R159	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R160	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R161	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R162	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R163	NO USE				
R164	RD14BB2C203J	RES. CARBON	20K	5%	1/6W
R201	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R202	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R203	RN14BK2C1200F	RES. METAL FILM	120	1%	1/6W
R204	RN14BK2C1200F	RES. METAL FILM	120	1%	1/6W
R205	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R206	RD14BB2C623J	RES. CARBON	62K	5%	1/6W
R207	RD14BB2C912J	RES. CARBON	9.1K	5%	1/6W
R208	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R209	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R210	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R211	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R212	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R213	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R214	RN14BK2C1800F	RES. METAL FILM	180	1%	1/6W
R215	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R216	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R217	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R218	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R219	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R220	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R221	RD14BB2C912J	RES. CARBON	9.1K	5%	1/6W
R222	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R223	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R224	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R225	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W

PARTS LIST

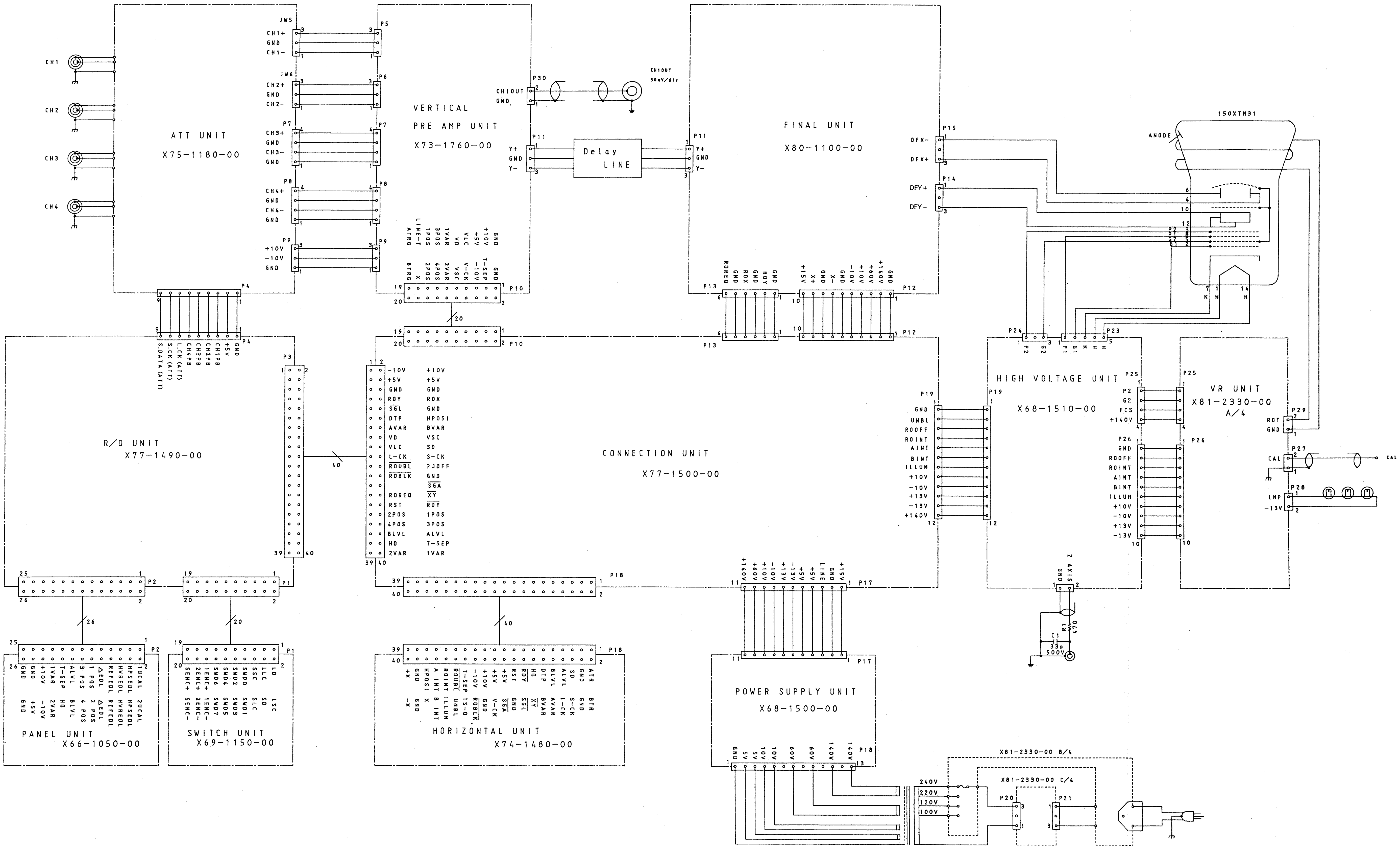
REF.NO	PARTS NO	NAME & DESCRIPTION			
R226	RN14BK2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R227	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R228	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R229	RD14BB2C163J	RES. CARBON	16K	5%	1/6W
R400	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R401	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
TC001	C05-0461-05	CAP. TRIMMER	30P		
TC002	C05-0460-05	CAP. TRIMMER	20P		
TC101	C05-0464-05	CAP. TRIMMER	2P		
TC102	NO USE				
TC103	C05-0464-05	CAP. TRIMMER	2P		
TH002	SDT100	THERMISTOR			
VR001	R12-1538-05	RES. SEMI FIXED	1KB		
VR002	NO USE				
VR003	R12-3453-05	RES. SEMI FIXED	10KB		
VR004	R12-0058-05	RES. SEMI FIXED	470 B		
VR101	R12-1538-05	RES. SEMI FIXED	1KB		
VR102	R12-0571-05	RES. SEMI FIXED	500B		
VR103	R12-3453-05	RES. SEMI FIXED	10KB		
VR201	R12-3543-05	RES. SEMI FIXED	20KB		
VR202	R12-3543-05	RES. SEMI FIXED	20KB		

VR UNIT

X81-2330-00

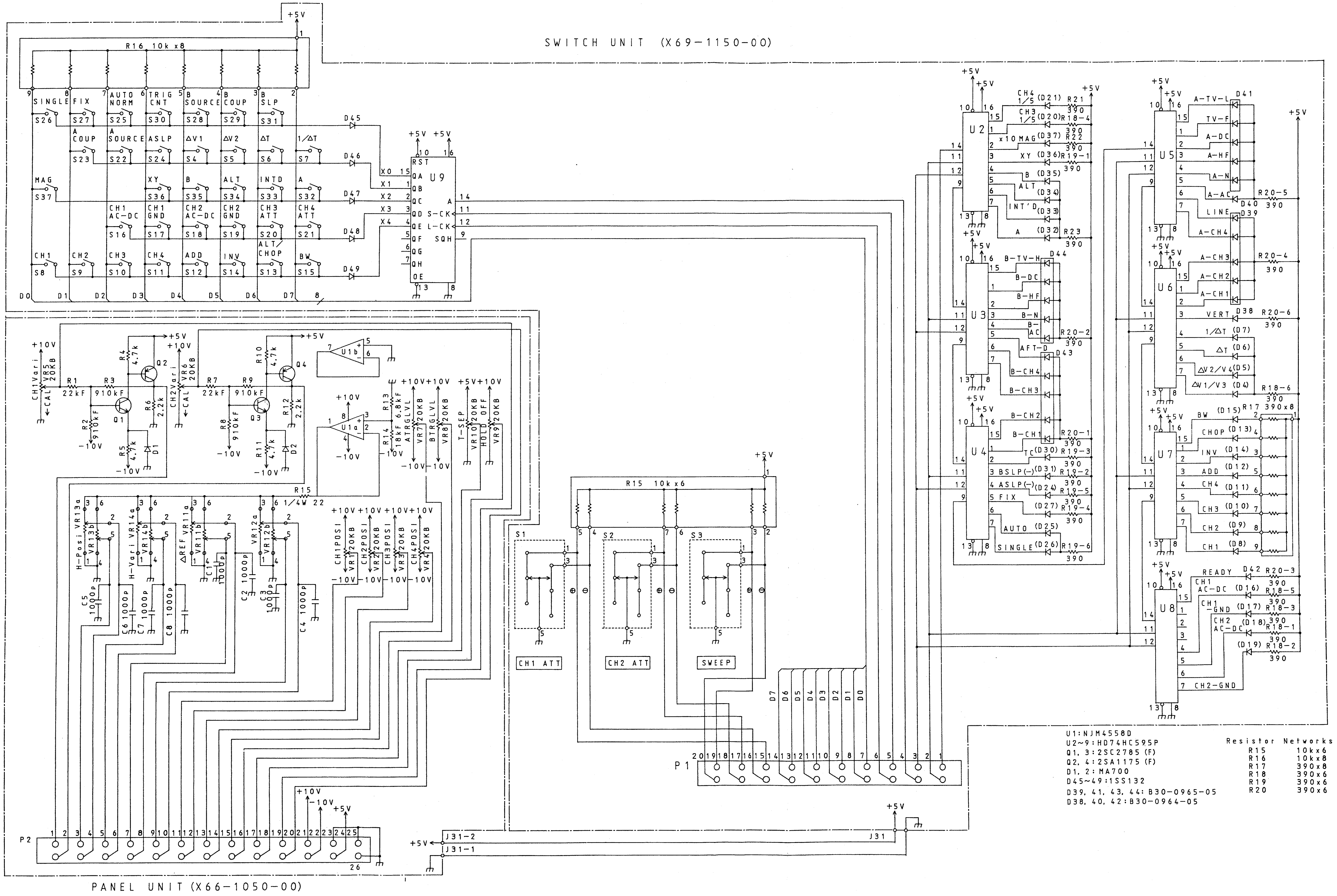
REF.NO	PARTS NO	NAME & DESCRIPTION			
	F01-0859-14	HEAT SINK			
	N09-0623-04	SCREW, SEMS	M3X8		
	R92-0150-05	JUMPING RES.	ZERO OHM(10MM)		
77	J21-4610-04	BRACKET			
C006	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C007	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C008	CK45FB2H472K	CAP. CERAMIC	4700P	10%	500V
C009	CQ92M1H103J	CAP. MYLAR	0.01	5%	50V
C010	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C101	C91-0551-05	CAP. POLYESTER	0.22	10%	630V
C102	C91-0575-05	CAP. CERAMIC	1000P		4KV
C103	C91-0575-05	CAP. CERAMIC	1000P		4KV
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	MTZ24JC	DIODE, ZENER	23.72V		
J021	E31-5571-05	LEAD WIRE WITH CONNECTOR			
L101	L33-0808-05	CHOKE COIL			
P020	E40-0330-05	PIN CONNECTOR	3P		
P021	E40-0330-05	PIN CONNECTOR	3P		
P025	E40-0474-05	PIN CONNECTOR	4P		
P026	E40-1074-05	PIN CONNECTOR	10P		
P027	E40-0273-05	PIN CONNECTOR	2P		
P028	E40-0274-05	PIN CONNECTOR	2P		
P029	E40-0274-05	PIN CONNECTOR	2P		
Q001	2SC2271(D)	TR. SI, NPN			
Q002	2SC1384(Q)	TR. SI, NPN			
Q003	2SA684(Q)	TR. SI, PNP			
Q004	2SA1175(F)	TR. SI, PNP			
Q005	2SC2785(F)	TR. SI, NPN			
Q006	2SD1666(S)	TR. SI, NPN			
R001	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R002	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R003	RD14BB2C183J	RES. CARBON	18K	5%	1/6W
R004	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R005	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R006	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R007	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R008	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R009	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R010	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R011	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R012	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R013	RD14BB2C433J	RES. CARBON	43K	5%	1/6W
R014	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R015	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R016	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R017	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R018	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R019	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R020	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R021	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R022	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R023	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R024	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R025	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R026	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R101	RD14BY2H225J	RES. CARBON	2.2M	5%	1/2W
S101	S59-2505-05	SWITCH			
U001	NJM4558D	IC, DUAL OP AMP			
VR001	R05-3515-05	V.R. WITH SW(READOUT INT) 20KB			
VR002	R10-3505-05	V.R.(A/B INT,ROT+ILLUM)20KB X2			
VR003	R10-7501-05	V.R.(FOCUS/ASTIG)500KB/500KB			
VR004	R10-3505-05	V.R.(A/B INT,ROT+ILLUM)20KB X2			
VR005	R12-3543-05	RES. SEMI FIXED	20KB		
VR006	R12-1538-05	RES. SEMI FIXED	1KB		

SCHEMATIC DIAGRAM



CH1
CH2
CH3
CH4
ATT UNIT
X75-1180-00
VERTICAL
PRE AMP UNIT
X73-1760-00
CH1OUT
GND
CH1OUT 50mV/div
Delay
LINE
FINAL UNIT
X80-1100-00
DFX-
DFX+
DFY+
DFY-
150XTM31
ANODE
R/O UNIT
X77-1490-00
CONNECTION UNIT
X77-1500-00
HIGH VOLTAGE UNIT
X68-1510-00
VR UNIT
X81-2330-00
A/4
ROT
GND
CAL
LMP
-13V
Z AXIS
GND
R1
47Ω
C1
33p
500V
PANEL UNIT
X66-1050-00
SWITCH UNIT
X69-1150-00
HORIZONTAL UNIT
X74-1480-00
POWER SUPPLY UNIT
X68-1500-00
X81-2330-00 B/4
X81-2330-00 C/4
240V
220V
120V
100V
P20
P21

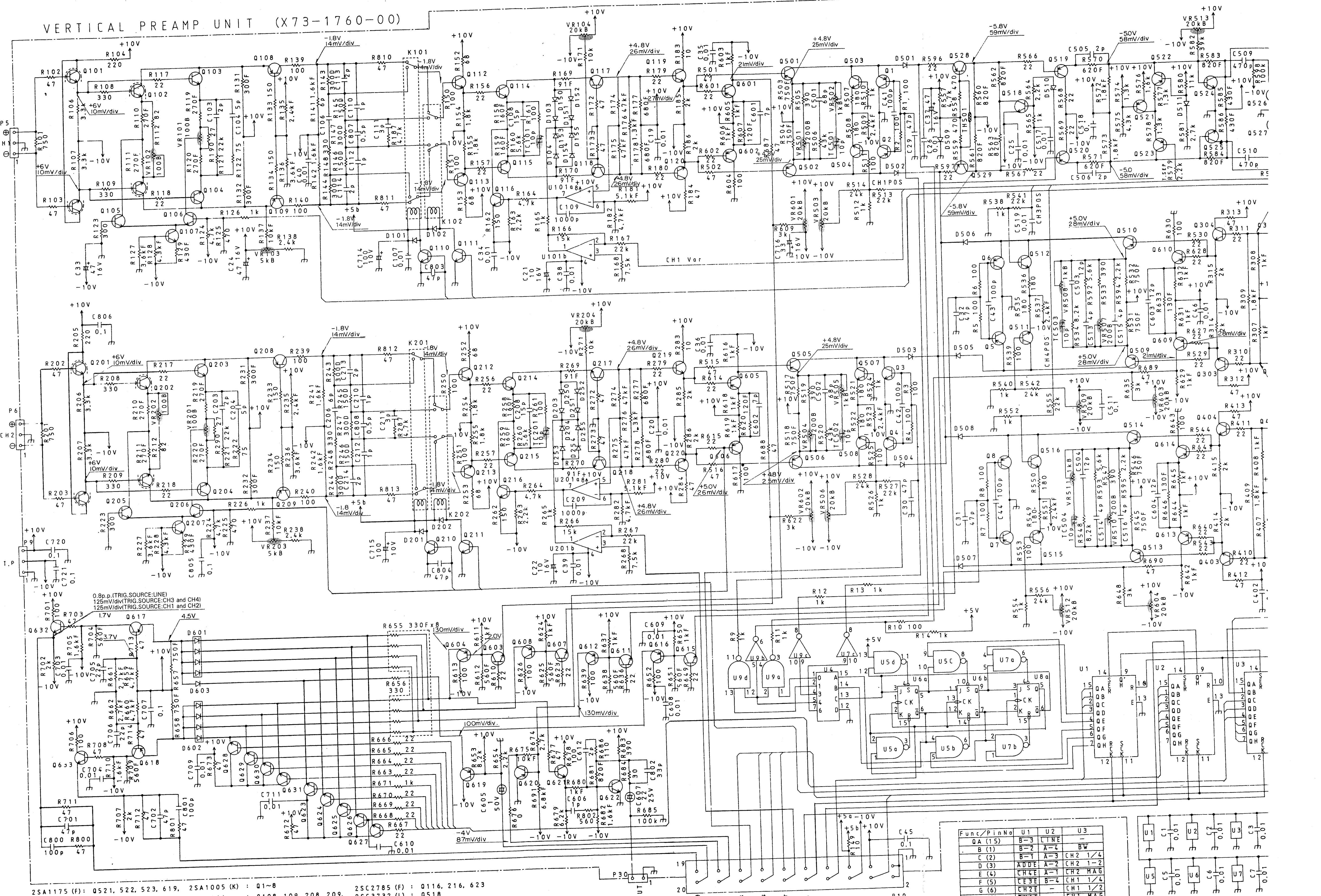
SCHEMATIC DIAGRAM


SWITCH UNIT (X69-1150-00)
PANEL UNIT (X66-1050-00)
R16 10k x8
+5V
SINGLE
FIX
AUTO NORM
TRIG CNT
B SOURCE
B COUP
B SLP
S26
S27
S25
S30
S28
S29
S31
A COUP
A SOURCE
ASLP
ΔV1
ΔV2
ΔT
1/ΔT
S23
S22
S24
S4
S5
S6
S7
MAG
S37
XY
B
ALT
INTD
A
S36
S35
S34
S33
S32
CH1 AC-DC
CH1 GND
CH2 AC-DC
CH2 GND
CH3 ATT
CH4 ATT
S16
S17
S18
S19
S20
S21
ALT/CHOP
CH1
CH2
CH3
CH4
ADD
INV
BW
S8
S9
S10
S11
S12
S14
S13
S15
D0
D1
D2
D3
D4
D5
D6
D7
D45
D46
D47
D48
D49
U9
RST
QA
QB
QC
QD
QE
QF
QG
QH
OE
S-CK
L-CK
SQH
U2
U3
U4
U5
U6
U7
U8
CH4 1/5
CH3 1/5
x10 MAG
XY
B
ALT
INT'D
A
B-TV-H
B-DC
B-HF
B-N
B-AC
AFT-D
B-CH4
B-CH3
B-CH2
B-CH1
TC
BSLP(-)
ASLP(-)
FIX
AUTO
SINGLE
A-TV-L
TV-F
A-DC
A-HF
A-N
A-AC
LINE
A-CH4
A-CH3
A-CH2
A-CH1
VERT
1/ΔT
ΔT
ΔV2/V4
ΔV1/V3
BW
CHOP
INV
ADD
CH4
CH3
CH2
CH1
READY
CH1 AC-DC
CH1 GND
CH2 AC-DC
CH2-GND
R17 390x8
R18-1
R18-2
R18-3
R18-4
R18-5
R18-6
R19-1
R19-2
R19-3
R19-4
R19-5
R19-6
R20-1
R20-2
R20-3
R20-4
R20-5
R20-6
R21
R22
R23
390
+10V
-10V
CH1 Vari VR5 20KB
CAL
CH2 Vari VR6 20KB
R1 22kF
R3 910kF
R2 910kF
R4 4.7k
R5 4.7k
R6 2.2k
Q1
Q2
D1
R7 22kF
R9 910kF
R8 910kF
R10 4.7k
R11 4.7k
R12 2.2k
Q3
Q4
D2
U1a
U1b
R13 6.8kF
R14 18kF
ATRGLVL VR7 20KB
BTRGLVL VR8 20KB
T-SEP VR10 20KB
HOLD OFF VR9 20KB
R15 1/4W 22
H-Posi VR13a
VR13b
H-Vari VR14a
VR14b
ΔREF VR11a
VR11b
VR12a
VR12b
C1 1000p
C2 1000p
C3 1000p
C4 1000p
C5 1000p
C6 1000p
C7 1000p
C8 1000p
CH1POSI VR1 20KB
CH2POSI VR2 20KB
CH3POSI VR3 20KB
CH4POSI VR4 20KB
R15 10k x6
S1
S2
S3
CH1 ATT
CH2 ATT
SWEEP
P1
P2
J31
J31-1
J31-2

U1:NJM4558D
U2~9:HD74HC595P
Q1, 3:2SC2785 (F)
Q2, 4:2SA1175 (F)
D1, 2:MA700
D45~49:1SS132
D39, 41, 43, 44:B30-0965-05
D38, 40, 42:B30-0964-05

Resistor	Networks
R15	10kx6
R16	10kx8
R17	390x8
R18	390x6
R19	390x6
R20	390x6

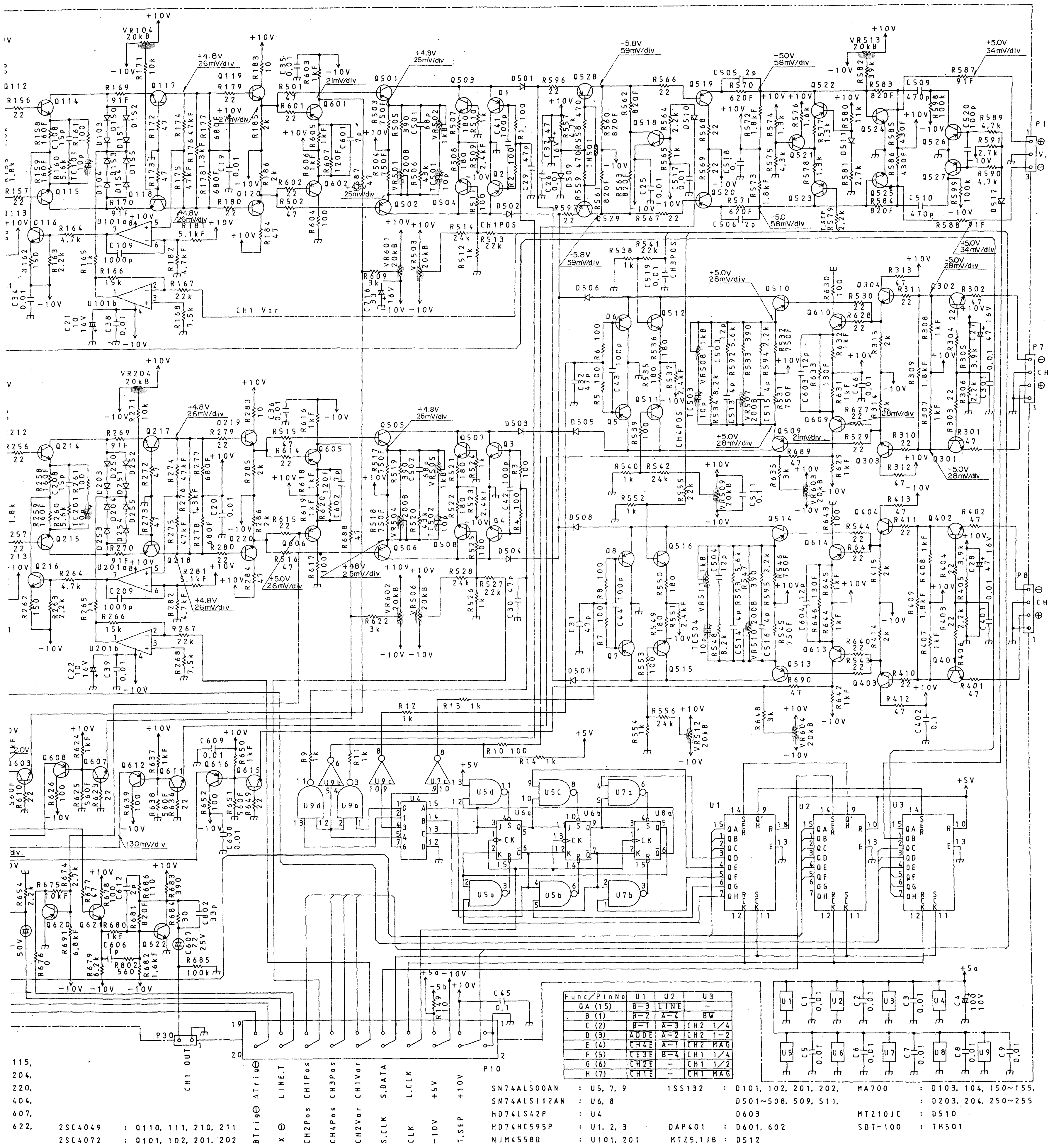
VERTICAL PREAMP UNIT (X73-1760-00)


P5
CH1
P6
CH2
ATT.P
P9
P30
CH1 OUT
P10
BTrig⊖ ATrig⊖
X ⊖ LINE.T
CH2Pos CH1Pos
CH4Pos CH3Pos
CH2Var CH1Var
S.CLK S.DATA
CLK L.CLK
−10V +5V
T.SEP +10V
0.8p.p.(TRIG.SOURCE:LINE)
125mV/div(TRIG.SOURCE:CH3 and CH4)
125mV/div(TRIG.SOURCE:CH1 and CH2)
CH1 Var
CH1POS
CH3POS
CH4POS
U1
U2
U3
U4
U5
U6
U7
U8
U9

Func/PinNo	U1	U2	U3
QA (15)	$\overline{\text{B-3}}$	$\overline{\text{LINE}}$	−
B (1)	$\overline{\text{B-2}}$	$\overline{\text{A-4}}$	$\overline{\text{BW}}$
C (2)	$\overline{\text{B-1}}$	$\overline{\text{A-3}}$	CH2 1/4
D (3)	$\overline{\text{ADDE}}$	$\overline{\text{A-2}}$	CH2 1−2
E (4)	$\overline{\text{CH4E}}$	$\overline{\text{A-1}}$	$\overline{\text{CH2 MAG}}$
F (5)	$\overline{\text{CE3E}}$	$\overline{\text{B-4}}$	CH1 1/4
G (6)	$\overline{\text{CH2E}}$	−	CH1 1/2
H (7)	$\overline{\text{CH1E}}$	−	$\overline{\text{CH1 MAG}}$

2SA1175 (F) : Q521, 522, 523, 619, Q620
2SA1206 : Q501, 502, 505, 506, Q509, 510, 513, 514, Q519, 520, 526, 527, Q601, 602, 604, 605, Q606, 608, 609, 610, Q612, 613, 614, 616
2SA1005 (K) : Q1~8
2SA1161 : Q108, 109, 208, 209, Q528, 529, 617, 618
2SC3315 (C) : Q105, 106, 107, 205, Q206, 207, 503, 504, Q507, 508, 511, 512, Q515, 516, 624, 625, Q626, 627, 628, 629, Q630, 631
2SC2785 (F) : Q116, 216, 623
2SC3732 (L) : Q518
2SC3779 (D) : Q103, 104, 112~115, Q117~120, 203, 204, Q212~215, 217~220, Q301~304, 401~404, Q524, 525, 603, 607, Q611, 615, 621, 622, Q632, 633
2SC4049 : Q110, 111, 210, 211
2SC4072 : Q101, 102, 201, 202
SN74ALS00AN : U5, 7, 9
SN74ALS112AN : U6, 8
HD74LS42P : U4
HD74HC595P : U1, 2, 3
NJM4558D : U101, 201
1SS132 : D101, 102, 201, 202, D501~508, 509, 511, D603
DAP401 : D601, 602
MTZ5.1JB : D512
MA700 :
MTZ10JC :
SDT-100 :

SCHEMATIC DIAGRAM


P11
V.OUT
P7
CH3
P8
CH4
P30
CH1 OUT
P10
BTrig⊖ ATrig⊖
X ⊖ LINE.T
CH2Pos CH1Pos
CH4Pos CH3Pos
CH2Var CH1Var
S.CLK S.DATA
CLK L.CLK
−10V +5V
T.SEP +10V
CH1 Var
U1
U2
U3
+5a
115,
204,
220,
404,
607,
622,

Func/PinNo	U1	U2	U3
QA (15)	$\overline{\text{B-3}}$	$\overline{\text{LINE}}$	–
B (1)	$\overline{\text{B-2}}$	$\overline{\text{A-4}}$	$\overline{\text{BW}}$
C (2)	$\overline{\text{B-1}}$	$\overline{\text{A-3}}$	CH2 1/4
D (3)	$\overline{\text{ADDE}}$	$\overline{\text{A-2}}$	CH2 1-2
E (4)	$\overline{\text{CH4E}}$	$\overline{\text{A-1}}$	$\overline{\text{CH2 MAG}}$
F (5)	$\overline{\text{CE3E}}$	$\overline{\text{B-4}}$	CH1 1/4
G (6)	$\overline{\text{CH2E}}$	–	CH1 1/2
H (7)	$\overline{\text{CH1E}}$	–	$\overline{\text{CH1 MAG}}$

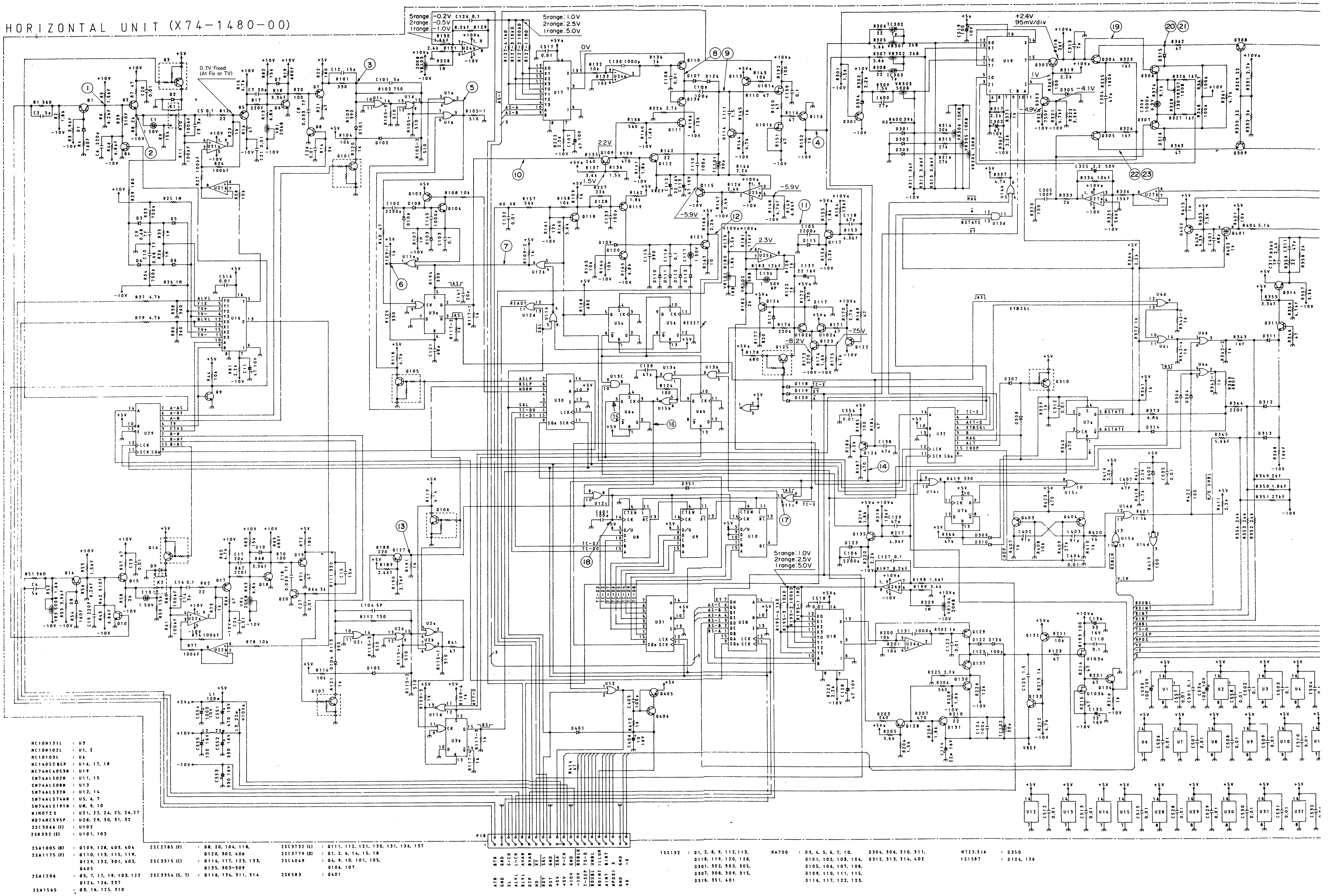
2SC4049 : Q110, 111, 210, 211
2SC4072 : Q101, 102, 201, 202

SN74ALS00AN : U5, 7, 9
SN74ALS112AN : U6, 8
HD74LS42P : U4
HD74HC595P : U1, 2, 3
NJM4558D : U101, 201

1SS132 : D101, 102, 201, 202, D501~508, 509, 511, D603
DAP401 : D601, 602
MTZ5.1JB : D512

MA700 : D103, 104, 150~155, : D203, 204, 250~255
MTZ10JC : D510
SDT-100 : TH501

HORIZONTAL UNIT (X74-1480-00)


5range: -0.2V
2range: -0.5V
1range: -1.0V
5range: 1.0V
2range: 2.5V
1range: 5.0V
0.7V Fixed
(At Fix or TV)
0V
2.2V
1.5V
-5.9V
2.3V
-8.2V
-7.5V
+2.4V
95mV/div
-4.9V
-4.1V
1V
P18
BTR
GND
S-CK
L-CK
AVAR
BVAR
XY
SGL
GND
SGA
V-CK
GND
ROBLK
TS-O
UNBL
ILLUM
BINT
X
GND
-X
ATR
GND
SL
ALVL
BLVL
DTP
HO
RDY
RST
+5V
+5V
+10V
-10V
T-SEP
ROUBL
ROINT
AINT
HPOSI
GND
+X

MC10H131L : U3
MC10H102L : U1, 2
MC10103L : U4
MC14052BCP : U16, 17, 18
MC74HC4053N : U19
SN74ALS02N : U11, 15
SN74ALS08N : U13
SN74ALS32N : U12, 14
SN74ALS74AN : U5, 6, 7
SN74ALS191N : U8, 9, 10
NJM072S : U21, 22, 24, 25, 26, 27
HD74HC595P : U28, 29, 30, 31, 32
2SC3066 (F) : U102
2SK332 (E) : U101, 103

2SA1005 (K) : Q109, 128, 403, 404
2SA1175 (F) : Q110, 113, 115, 119, Q129, 132, 301, 402, Q405
2SA1206 : Q5, 7, 17, 19, 103, 122 Q124, 126, 237
2SA1565 : Q3, 16, 125, 310

2SC2785 (F) : Q8, 20, 104, 118, Q120, 302, 406
2SC3315 (C) : Q114, 117, 123, 133, Q135, 303~309
2SC3354 (S, T) : Q116, 134, 311, 314

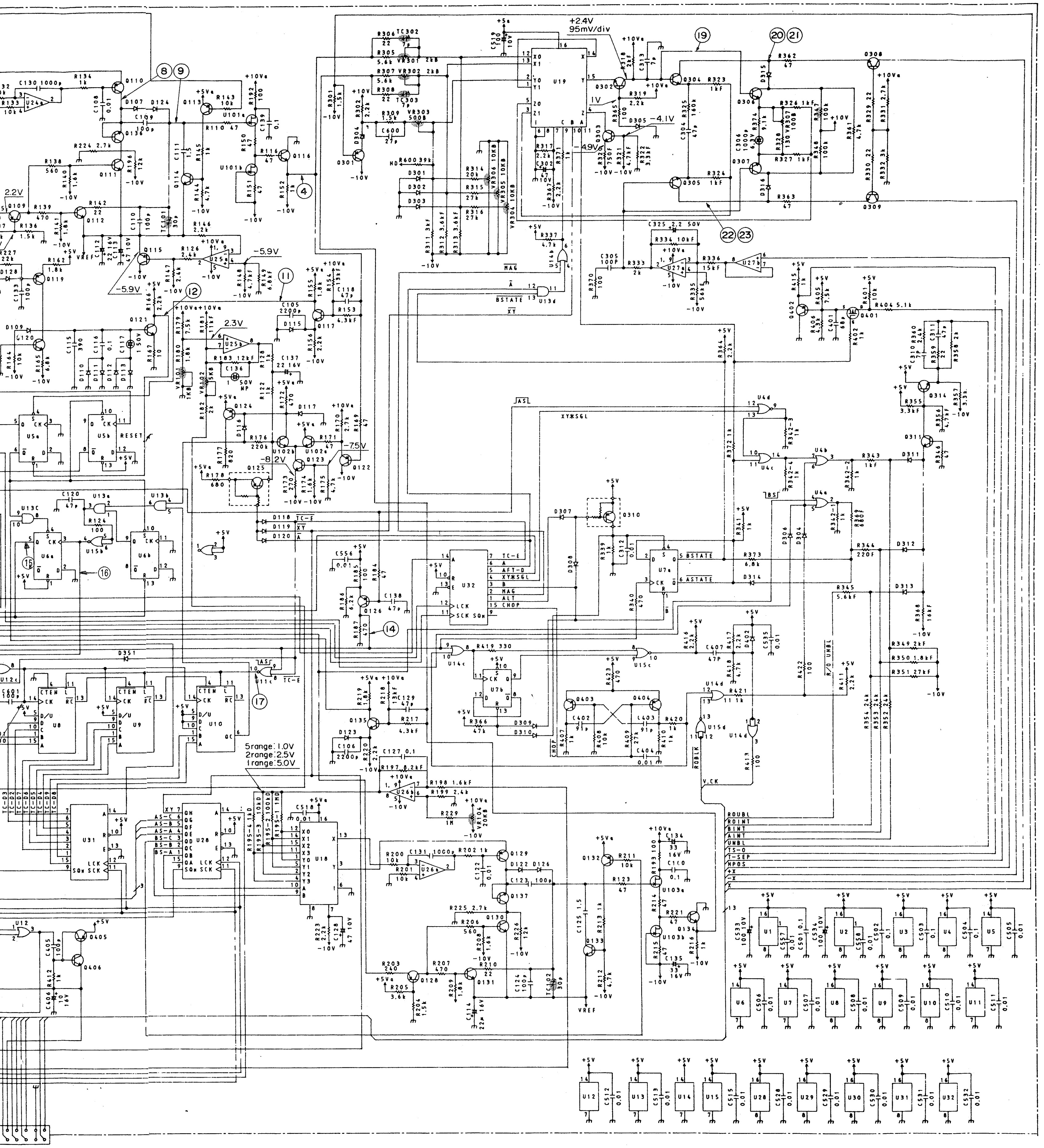
2SC3732 (L) : Q111, 112, 121, 130, 131, 136, 137
2SC3779 (D) : Q1, 2, 6, 14, 15, 18
2SC4049 : Q4, 9, 10, 101, 105, Q106, 107
2SK583 : Q401

1SS132 : D1, 2, 8, 9, 112, 113, D118, 119, 120, 128, D301, 302, 303, 305, D307, 308, 309, 315, D316, 351, 401

MA700 : D3, 4, 5, 6, 7, 10, D101, 102, 103, 104, D105, 106, 107, 108, D109, 110, 111, 115, D116, 117, 122, 123, D304, 306, 310, 311, D312, 313, 314, 402

MTZ3.3JA : D350
1S1587 : D124, 126

SCHEMATIC DIAGRAM



1SS132 : D1, 2, 8, 9, 112,113,
D118, 119, 120, 128,
D301, 302, 303, 305,
D307, 308, 309, 315,
D316, 351, 401

MA700 : D3, 4, 5, 6, 7, 10,
D101, 102, 103, 104,
D105, 106, 107, 108,
D109, 110, 111, 115,
D116, 117, 122, 123,
D304, 306, 310, 311,
D312, 313, 314, 402

MTZ3.3JA : D350
1S1587 : D124, 126

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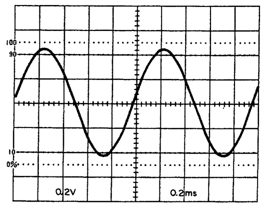

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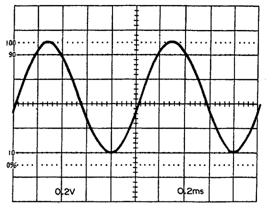

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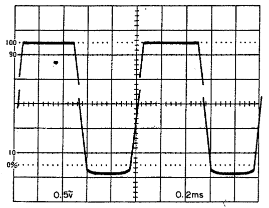

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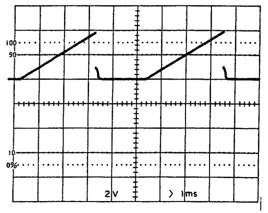

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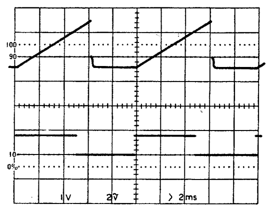

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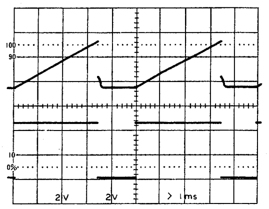

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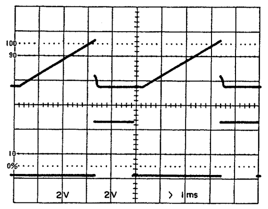

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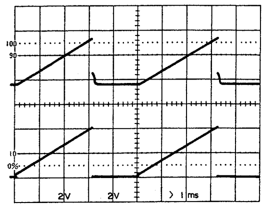

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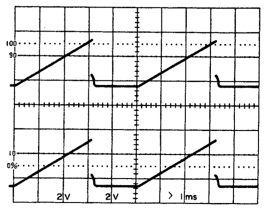

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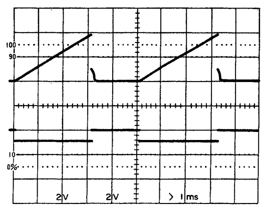

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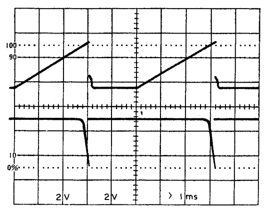

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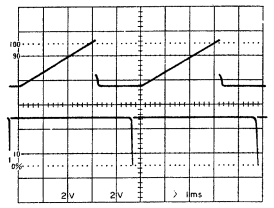

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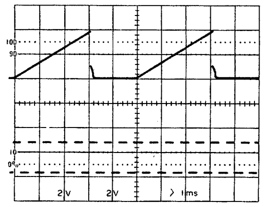

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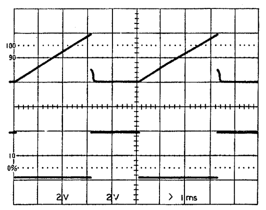
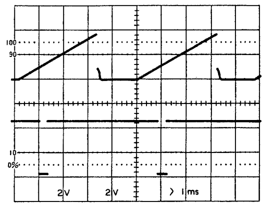
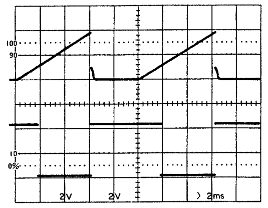


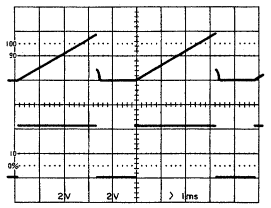
⑮



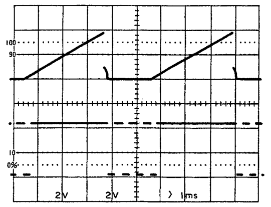
⑯



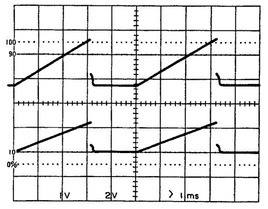
⑰



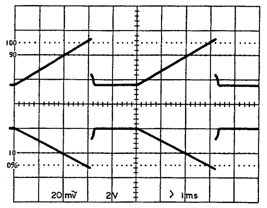
⑱



⑲



⑳



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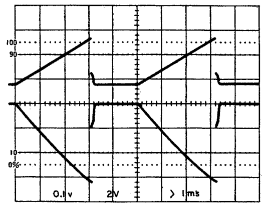

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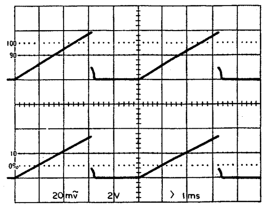

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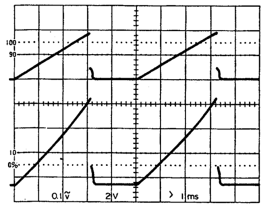
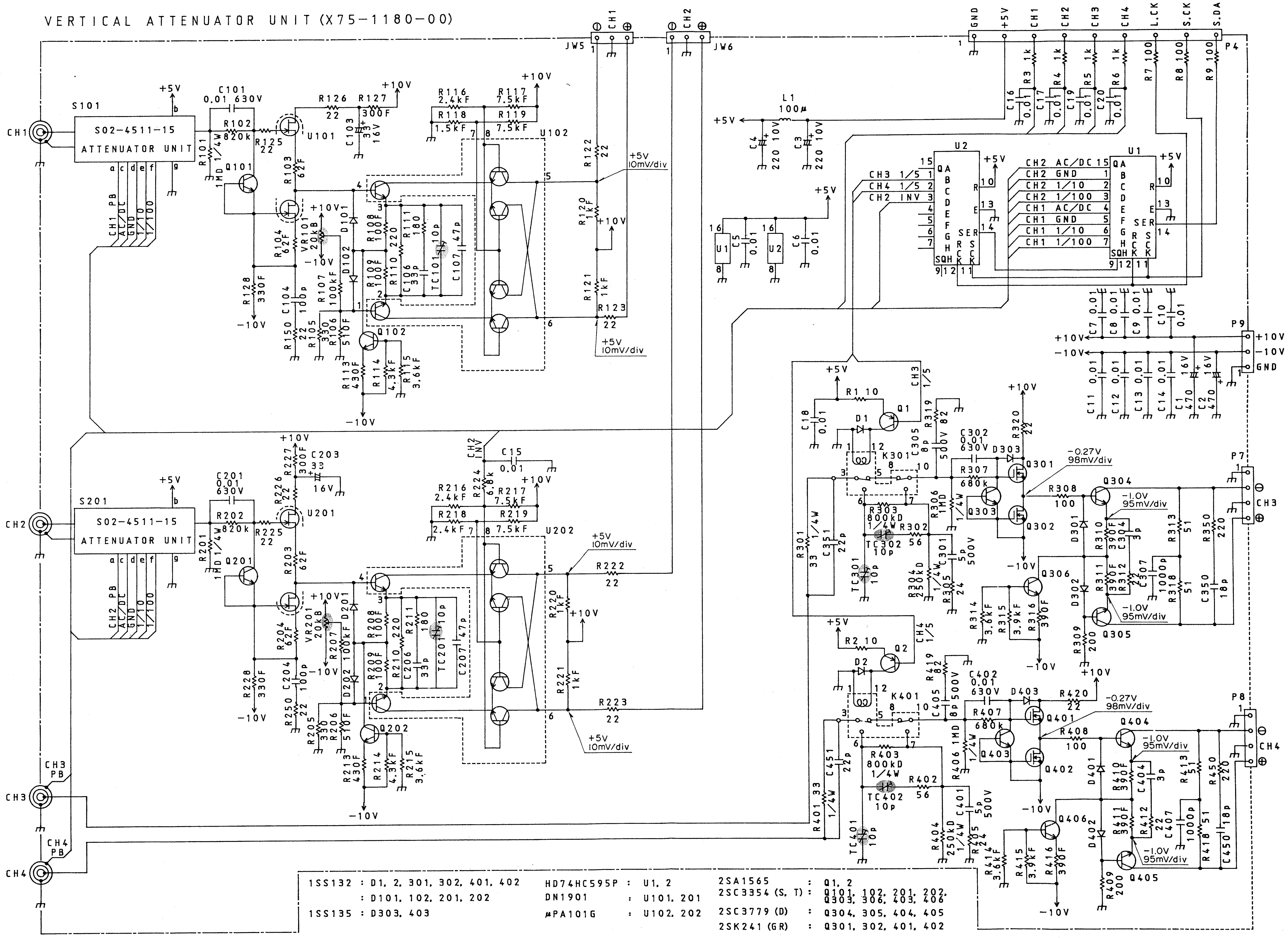


SCHEMATIC DIAGRAM

VERTICAL ATTENUATOR UNIT (X75-1180-00)


CH1
CH2
CH3 PB
CH4 PB
CH3
CH4
S101
S201
S02-4511-15
ATTENUATOR UNIT
U101
U102
U201
U202
Q101
Q102
Q201
Q202
JW5
JW6
P4
P7
P8
P9
U1
U2
L1 100µ
GND
+5V
CH1 PB
CH2 PB
CH3 PB
CH4 PB
L.CK
S.CK
S.DATA
+10V
-10V
+5V 10mV/div
-0.27V 98mV/div
-1.0V 95mV/div
K301
K401
Q301
Q302
Q303
Q304
Q305
Q306
Q401
Q402
Q403
Q404
Q405
Q406

1SS132 : D1, 2, 301, 302, 401, 402
: D101, 102, 201, 202
1SS135 : D303, 403

HD74HC595P : U1, 2
DN1901 : U101, 201
µPA101G : U102, 202

2SA1565 : Q1, 2
2SC3354 (S, T) : Q101, 102, 201, 202, Q303, 306, 403, 406
2SC3779 (D) : Q304, 305, 404, 405
2SK241 (GR) : Q301, 302, 401, 402

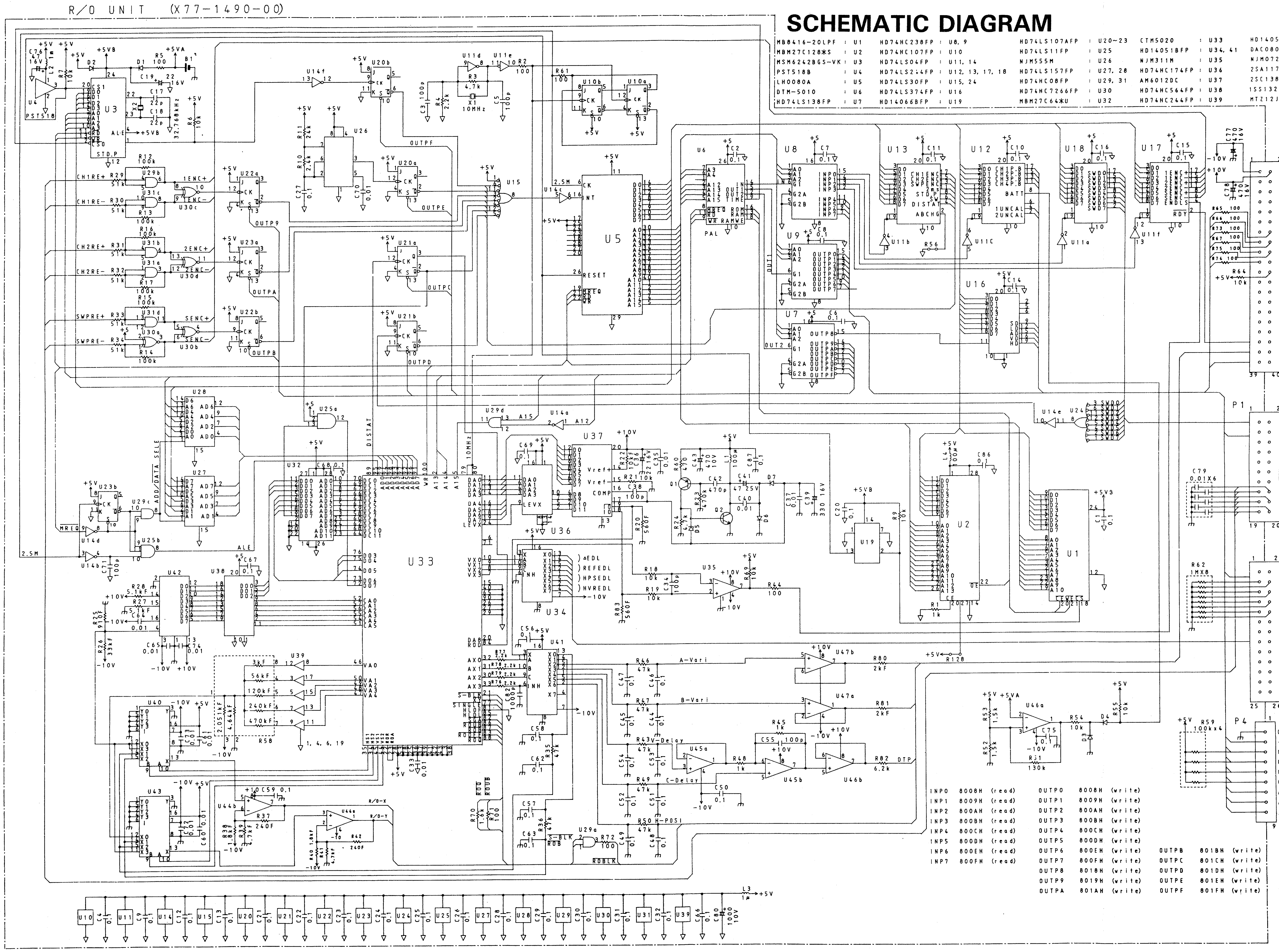
FUNC/PinNo	U1	U2
E (4)	CH1 AC/DC	—
F (5)	CH1 GND	—
G (6)	CH1 1/10	—
H (7)	CH1 1/100	—

FUNC/PinNo	U1	U2
QA (15)	CH2 AC/DC	—
B (1)	CH2 GND	CH3 1/5
C (2)	CH2 1/10	CH4 1/5
D (3)	CH2 1/100	CH2 INV

SCHEMATIC DIAGRAM

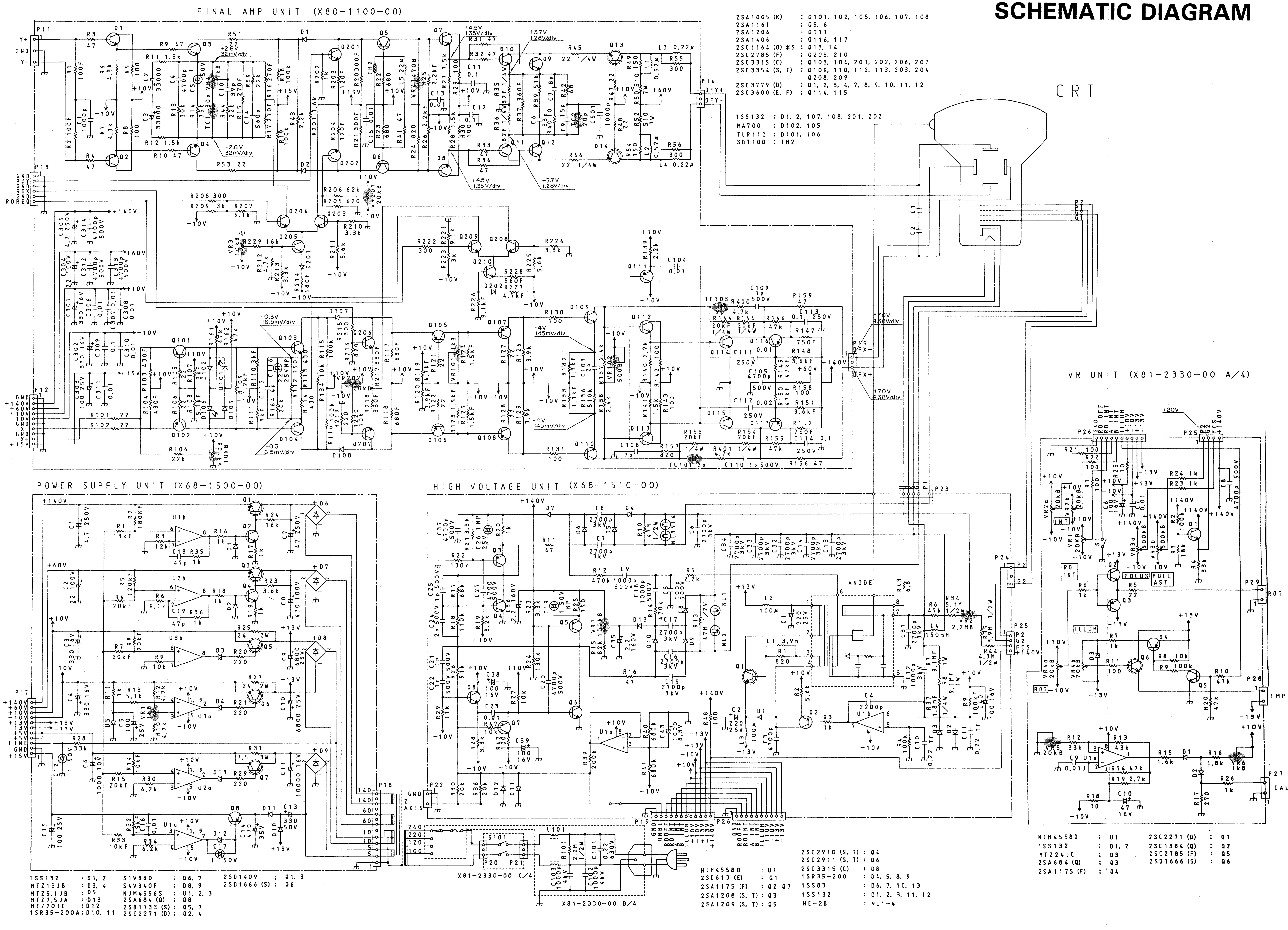
R/O UNIT (X77-1490-00)

MB8416-20LPF	U1	HD74HC238FP	U8, 9	HD74LS107AFP	U20~23	CTM5020	U33	HD14052BFP	U40, 43
MBM27C128*S	U2	HD74HC107FP	U10	HD74LS11FP	U25	HD14051BFP	U34, 41	DAC0808LCN	U42
MSM6242BGS-VK	U3	HD74LS04FP	U11, 14	NJM555M	U26	NJM311M	U35	NJM072M	U44~47
PST518B	U4	HD74LS244FP	U12, 13, 17, 18	HD74LS157FP	U27, 28	HD74HC174FP	U36	2SA1175 (F)	Q1
LH0080A	U5	HD74LS30FP	U15, 24	HD74HC08FP	U29, 31	AM6012DC	U37	2SC1384 (R, S)	Q2
DTM-5010	U6	HD74LS374FP	U16	HD74HC7266FP	U30	HD74HC564FP	U38	1SS132	D1~4, 6, 7
HD74LS138FP	U7	HD14066BFP	U19	MBM27C64*U	U32	HD74HC244FP	U39	MTZ12JC	D5


U1
U2
U3
U4
U5
U6
U7
U8
U9
U12
U13
U16
U17
U18
U33
U34
U36
U37
P1
P2
P3
P4
PAL
10MHz
32.768kHz
A-Vari
B-Vari
C-Delay
H-POSI
DTP
R/O-X
R/O-Y
ALE
MREQ
2.5M
DISTAT
ADD/DATA SELE

INP0	8008H	(read)	OUTP0	8008H	(write)			
INP1	8009H	(read)	OUTP1	8009H	(write)			
INP2	800AH	(read)	OUTP2	800AH	(write)			
INP3	800BH	(read)	OUTP3	800BH	(write)			
INP4	800CH	(read)	OUTP4	800CH	(write)			
INP5	800DH	(read)	OUTP5	800DH	(write)			
INP6	800EH	(read)	OUTP6	800EH	(write)	OUTPB	801BH	(write)
INP7	800FH	(read)	OUTP7	800FH	(write)	OUTPC	801CH	(write)
			OUTP8	8018H	(write)	OUTPD	801DH	(write)
			OUTP9	8019H	(write)	OUTPE	801EH	(write)
			OUTPA	801AH	(write)	OUTPF	801FH	(write)

SCHEMATIC DIAGRAM


FINAL AMP UNIT (X80-1100-00)
CRT
VR UNIT (X81-2330-00 A/4)
POWER SUPPLY UNIT (X68-1500-00)
HIGH VOLTAGE UNIT (X68-1510-00)
X81-2330-00 C/4
X81-2330-00 B/4

2SA1005 (K) : Q101, 102, 105, 106, 107, 108
2SA1161 : Q5, 6
2SA1206 : Q111
2SA1406 : Q116, 117
2SC1164 (O) ✱S : Q13, 14
2SC2785 (F) : Q205, 210
2SC3315 (C) : Q103, 104, 201, 202, 206, 207
2SC3354 (S, T) : Q109, 110, 112, 113, 203, 204
Q208, 209
2SC3779 (D) : Q1, 2, 3, 4, 7, 8, 9, 10, 11, 12
2SC3600 (E, F) : Q114, 115

1SS132 : D1, 2, 107, 108, 201, 202
MA700 : D102, 105
TLR112 : D101, 106
SDT100 : TH2

1SS132 : D1, 2
MTZ13JB : D3, 4
MTZ5.1JB : D5
MTZ7.5JA : D13
MTZ20JC : D12
1SR35-200A : D10, 11

S1VB60 : D6, 7
S4VB40F : D8, 9
NJM4556S : U1, 2, 3
2SA684 (Q) : Q8
2SB1133 (S) : Q5, 7
2SC2271 (D) : Q2, 4

2SD1409 : Q1, 3
2SD1666 (S) : Q6

NJM4558D : U1
2SD613 (E) : Q1
2SA1175 (F) : Q2 Q7
2SA1208 (S, T) : Q3
2SA1209 (S, T) : Q5

2SC2910 (S, T) : Q4
2SC2911 (S, T) : Q6
2SC3315 (C) : Q8
1SR35-200 : D4, 5, 8, 9
1SS83 : D6, 7, 10, 13
1SS132 : D1, 2, 3, 11, 12
NE-2B : NL1~4

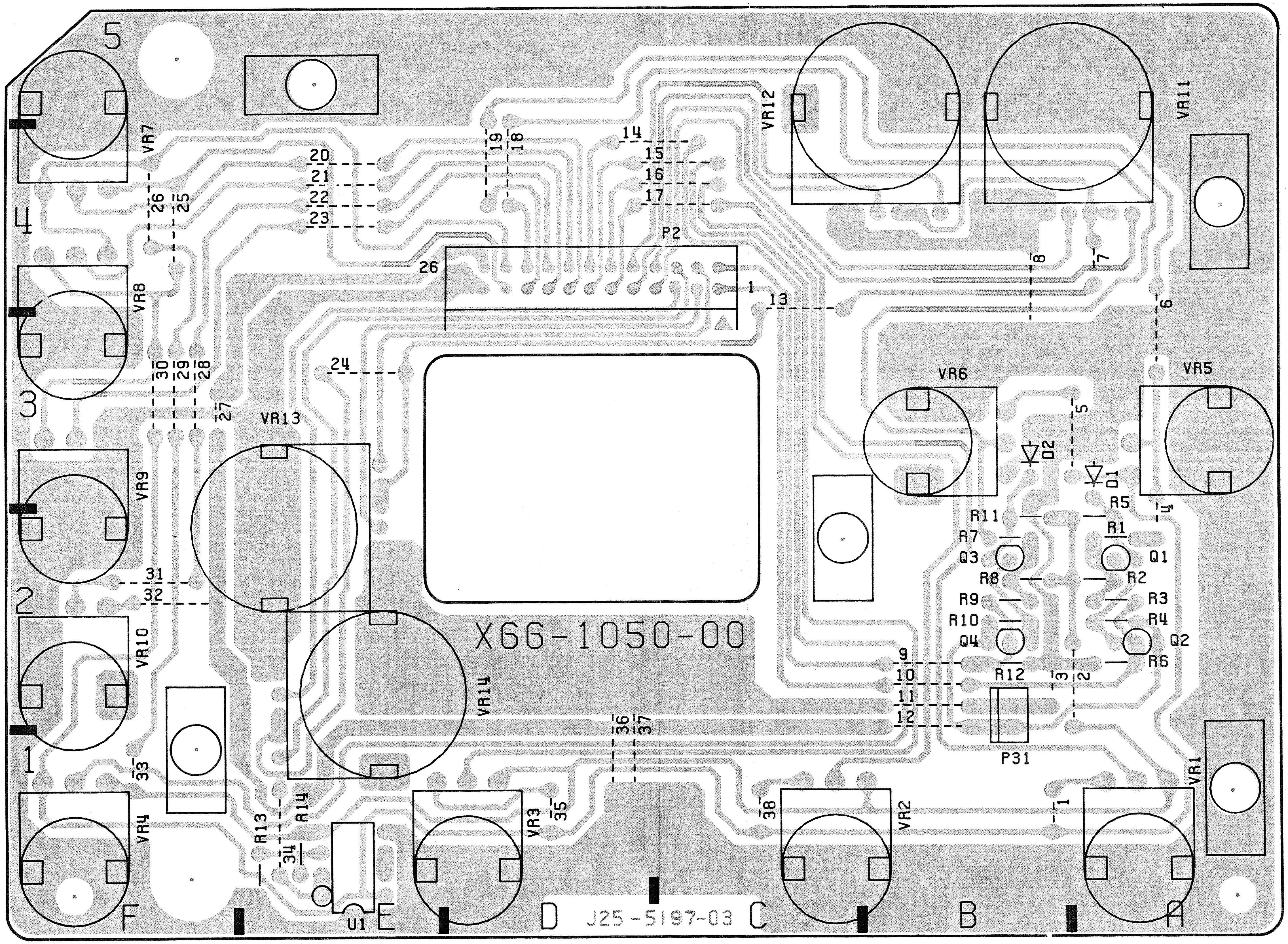
NJM4558D : U1
1SS132 : D1, 2
MTZ24JC : D3
2SA684 (Q) : Q3
2SA1175 (F) : Q4

2SC2271 (D) : Q1
2SC1384 (Q) : Q2
2SC2785 (F) : Q5
2SD1666 (S) : Q6

P.C BOARD

PANEL UNIT (X66-1050-00)

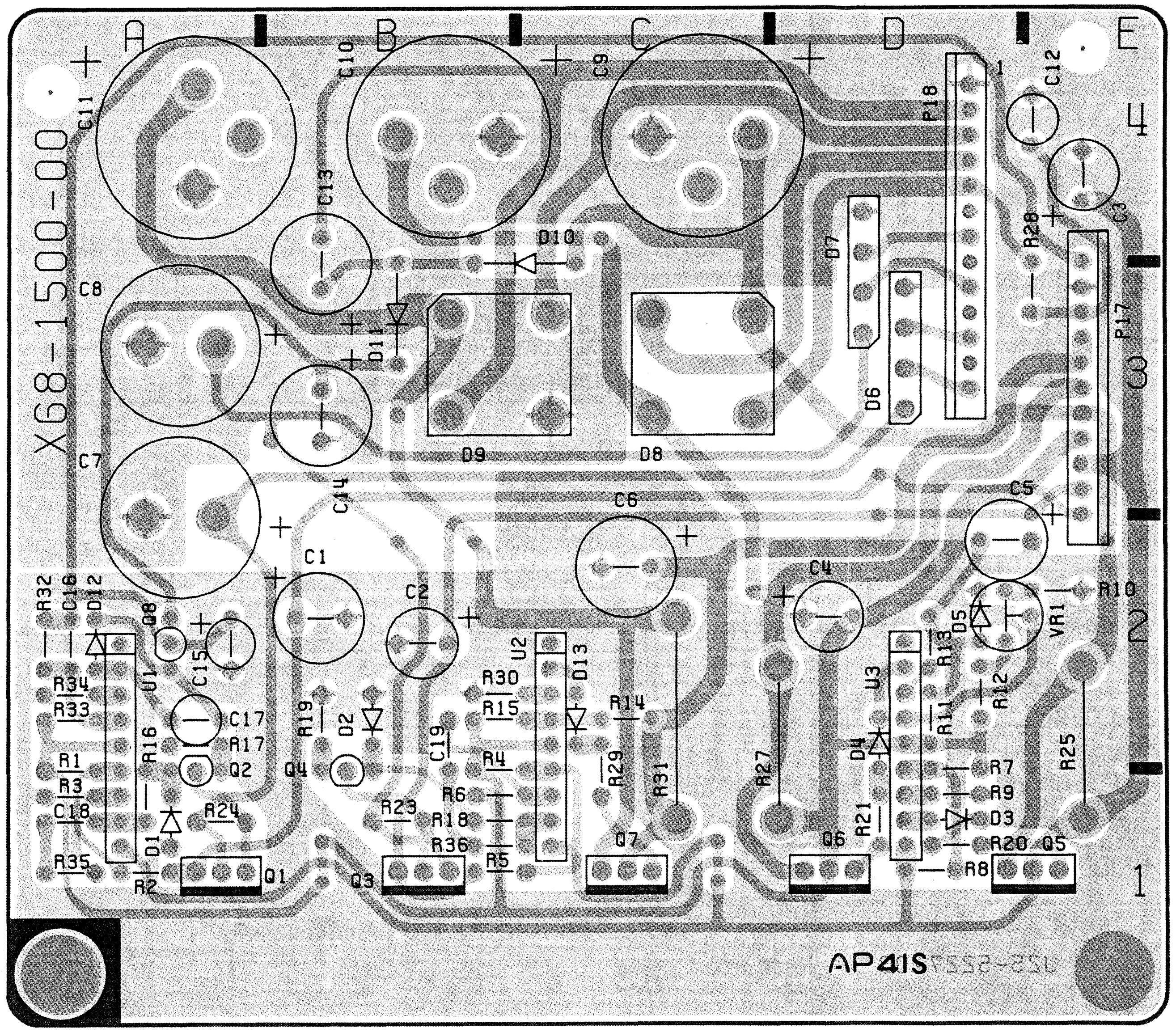
Pattern side view



5
4
3
2
1
VR7
VR8
VR9
VR10
VR4
VR13
VR14
VR3
VR2
VR1
VR5
VR6
VR11
VR12
P2
26
1
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
R13
R14
U1
F
E
D
C
B
A
J25-5197-03
X66-1050-00
D1
D2
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
Q1
Q2
Q3
Q4
P31
1
2
3
4
5
6
7
8
9
10
11
12

P.C BOARD

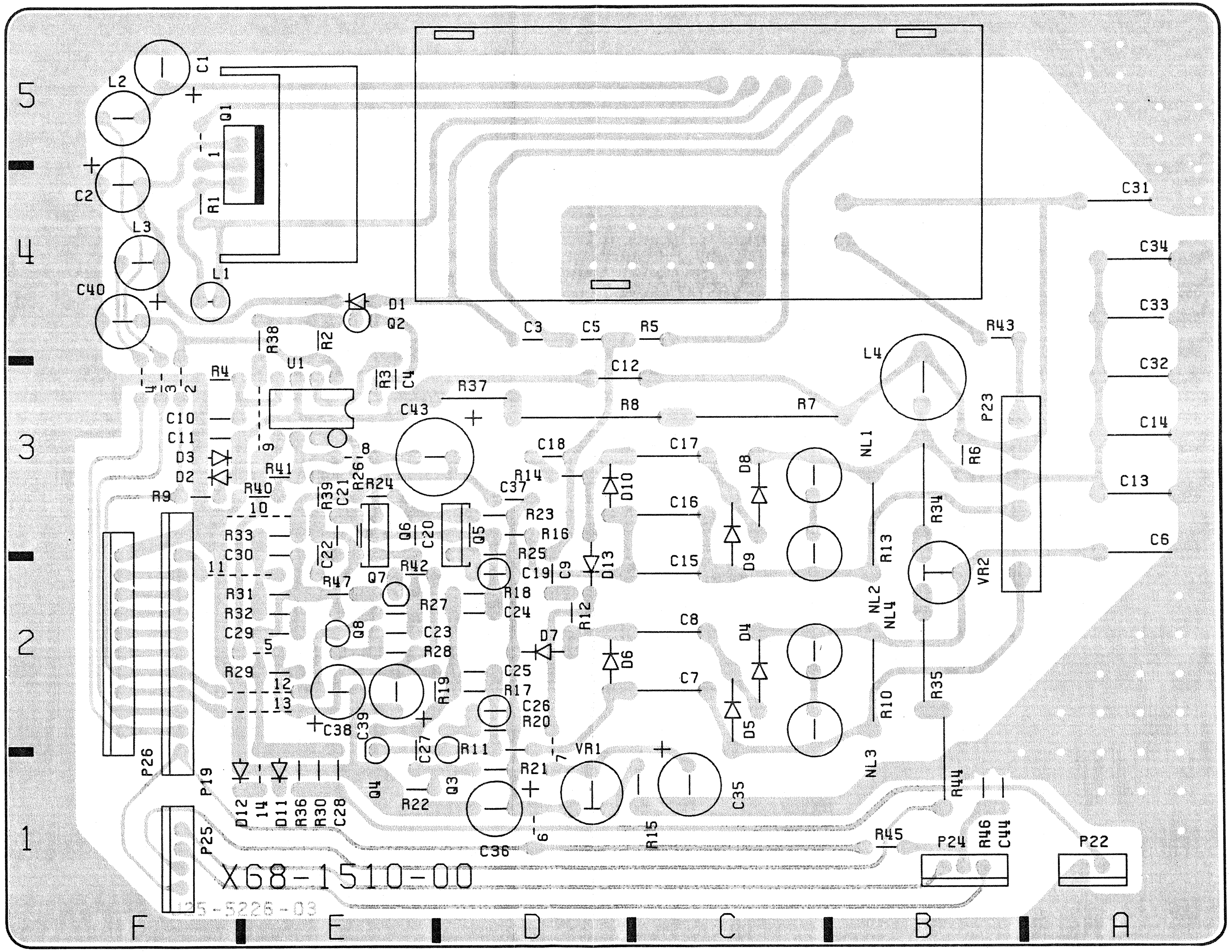
POWER SUPPLY UNIT (X68-1500-00)


A
B
C
D
E
X68-1500-00
C11
C10
C9
C12
P18
1
4
C3
C13
D10
D7
R28
P17
C8
D11
D6
3
D9
D8
C7
C14
C6
C5
C1
C2
C4
R32
C16
D12
Q8
U1
C15
VR1
R10
D5
2
R13
R12
U2
D13
R30
R15
R14
U3
R34
R33
C17
R17
Q2
R16
R19
D2
C19
R4
R29
R31
R27
D4
R11
R7
R9
D3
R20
Q5
R25
R21
R1
R3
C18
D1
R24
Q4
R23
R6
R18
R36
R5
Q7
Q6
R8
R35
R2
Q1
Q3
1
AP41S

P.C BOARD

HIGH VOLTAGE UNIT (X68-1510-00)

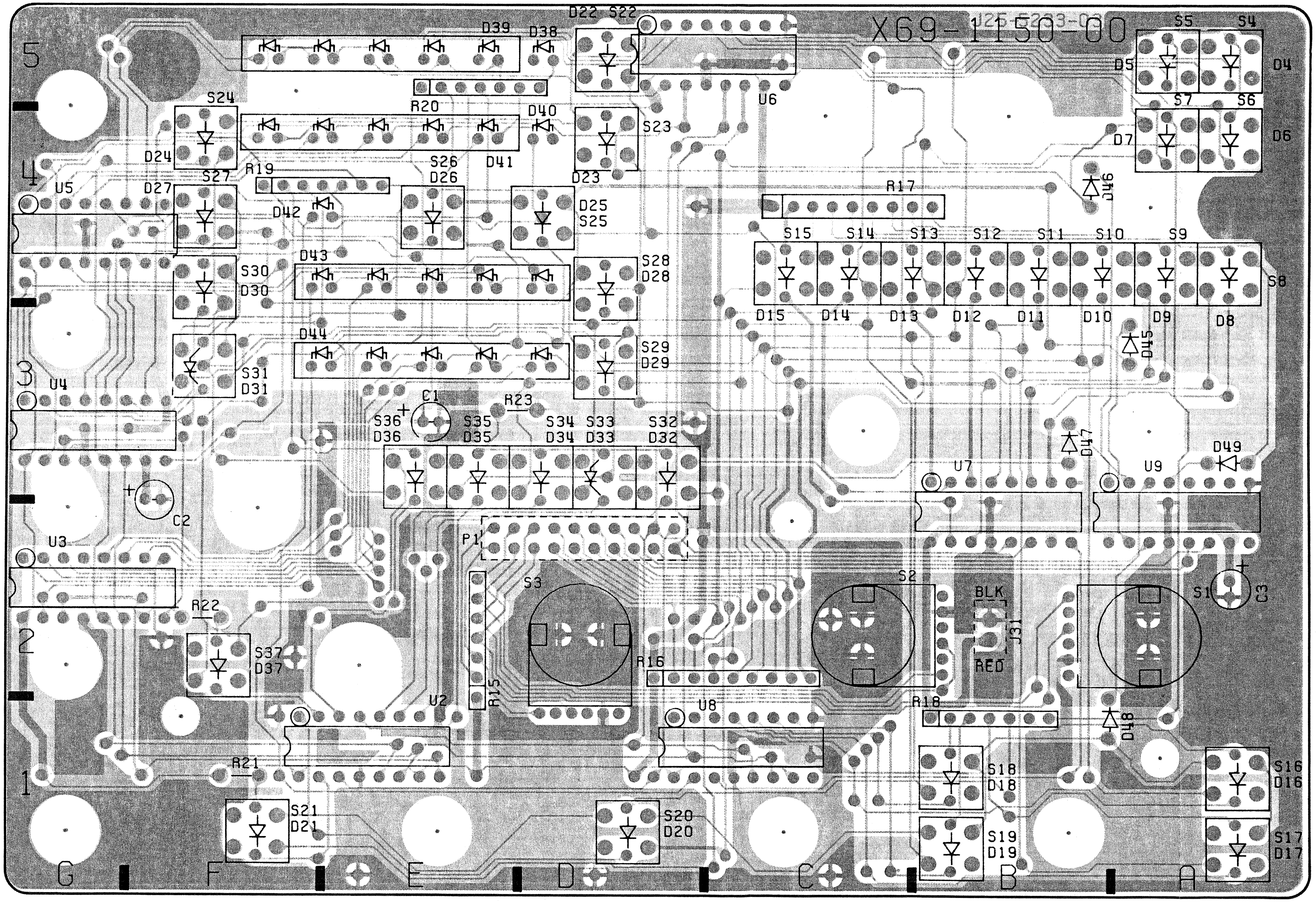
Pattern side view


X68-1510-00
J25-5226-03
C1
L2
Q1
C2
R1
L3
L1
C40
D1
Q2
R38
R2
U1
R3
C4
R4
R37
C43
C10
C11
D3
D2
R9
R41
R40
R39
C21
R26
R24
R33
C30
R31
R32
C29
R29
Q6
C20
Q5
R42
R47
Q7
Q8
R27
C23
R28
C38
C39
R19
C27
R11
Q4
Q3
R22
D12
D11
R36
R30
C28
P26
P19
P25
C36
VR1
C35
R15
R21
R20
C26
R17
C25
D7
R12
C24
R18
C19
C9
D13
R25
R16
R23
C37
R14
C18
C3
C5
R5
C12
R8
R7
C17
D10
D8
C16
D9
C15
C8
D4
D6
C7
D5
L4
NL1
NL2
NL4
NL3
R13
R10
R34
R35
VR2
P23
R6
R43
C31
C34
C33
C32
C14
C13
C6
R44
R45
P24
R46
C44
P22
5
4
3
2
1
F
E
D
C
B
A

P.C BOARD

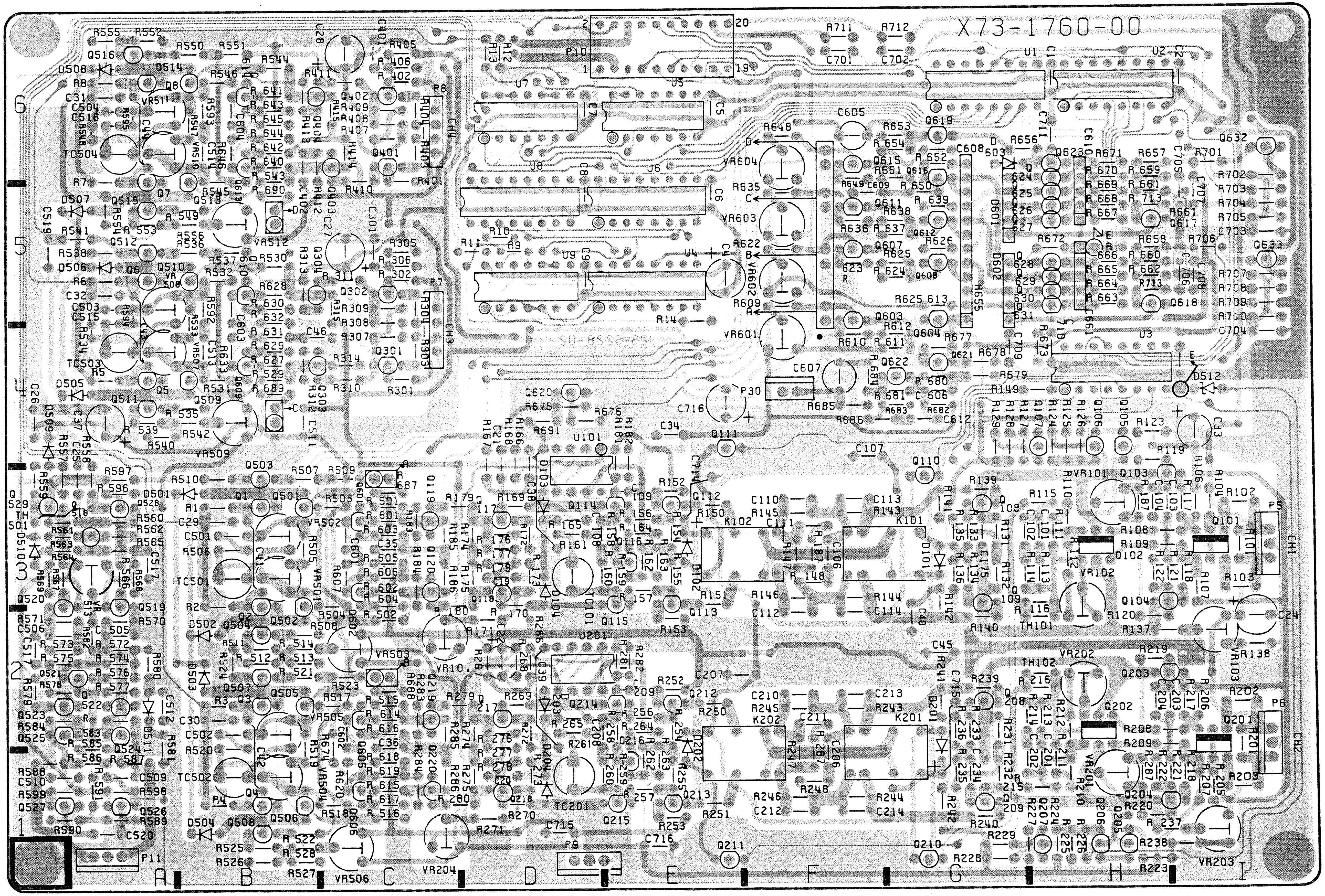
SWITCH UNIT (X69-1150-00)

Pattern side view


X69-1150-00
D22 S22
D39
D38
S5
S4
D5
D4
S7
S6
D7
D6
R20
U6
S24
D40
S23
D24
S26
D41
D23
D26
D25
S25
R19
S27
D27
D46
R17
D42
U5
S15
S14
S13
S12
S11
S10
S9
S8
D43
S28
D28
S30
D30
D15
D14
D13
D12
D11
D10
D9
D8
D44
D45
S29
D29
S31
D31
U4
C1
R23
S36
D36
S35
D35
S34
D34
S33
D33
S32
D32
D47
D49
U7
U9
C2
U3
P1
S3
S2
BLK
J31
RED
S1
C3
R22
R16
S37
D37
R15
U2
U8
R18
D48
R21
S18
D18
S16
D16
S21
D21
S20
D20
S19
D19
S17
D17
5
4
3
2
1
G
F
E
D
C
B
A

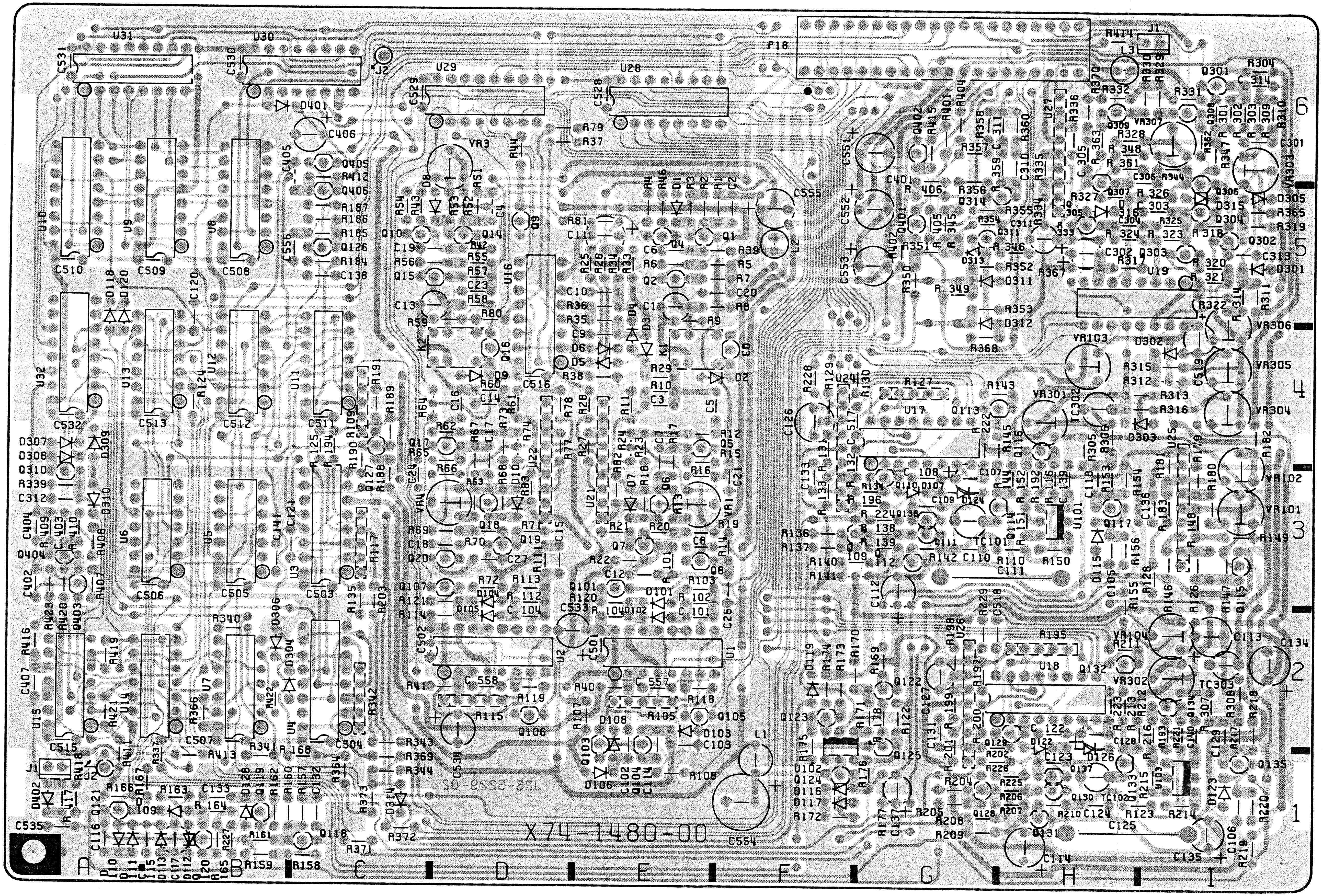
P.C BOARD

VERTICAL PREAMP UNIT (X73-1760-00)


X73-1760-00
A
B
C
D
E
F
G
H
I
1
2
3
4
5
6
P10
U1
U2
U3
U4
U5
U6
U7
U8
U9
U101
U201
K101
K102
K201
K202
P5
P6
P7
P8
P9
P11
P30
CH1
CH2
CH3
CH4
VR101
VR102
VR103
VR201
VR202
VR203
VR204
VR501
VR502
VR503
VR504
VR505
VR506
VR507
VR508
VR509
VR510
VR511
VR512
VR513
VR601
VR602
VR603
VR604
TC501
TC502
TC503
TC504
TC101
TC201
TH101
TH102
TH501
D601
D602
D603

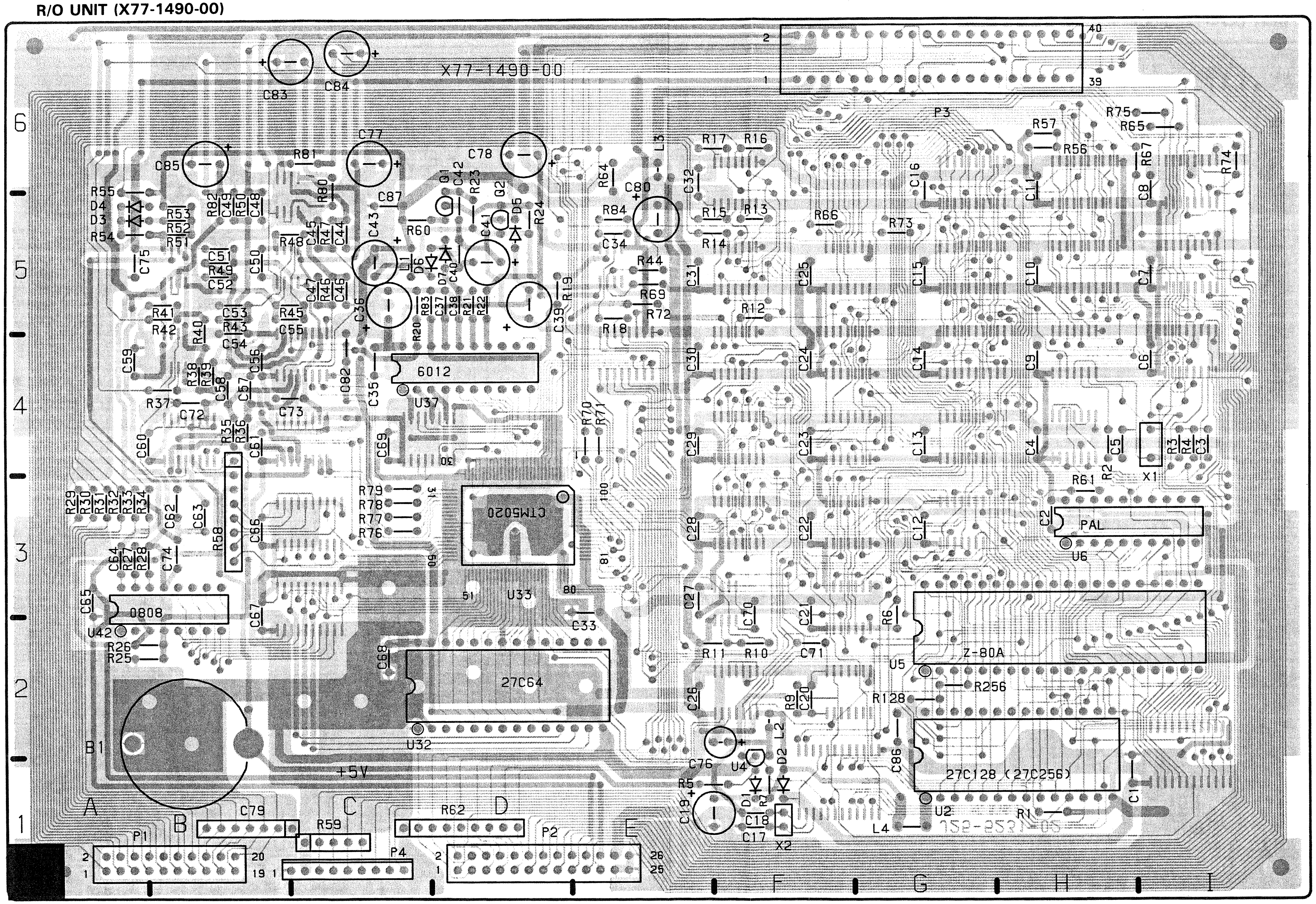
P.C BOARD

HORIZONTAL UNIT (X74-1480-00)


X74-1480-00
J25-5229-02
U31
U30
U29
U28
U27
U26
U25
U24
U22
U21
U19
U18
U17
U16
U15
U14
U13
U12
U11
U10
U9
U8
U7
U6
U5
U4
U3
U2
U1
U32
U101
U103
P18
J1
J2
L1
L2
L3
K1
K2
VR1
VR3
VR4
VR101
VR102
VR103
VR104
VR301
VR302
VR303
VR304
VR305
VR306
VR307
TC101
TC102
TC301
TC302
TC303
C554
C555
A
B
C
D
E
F
G
H
I
1
2
3
4
5
6

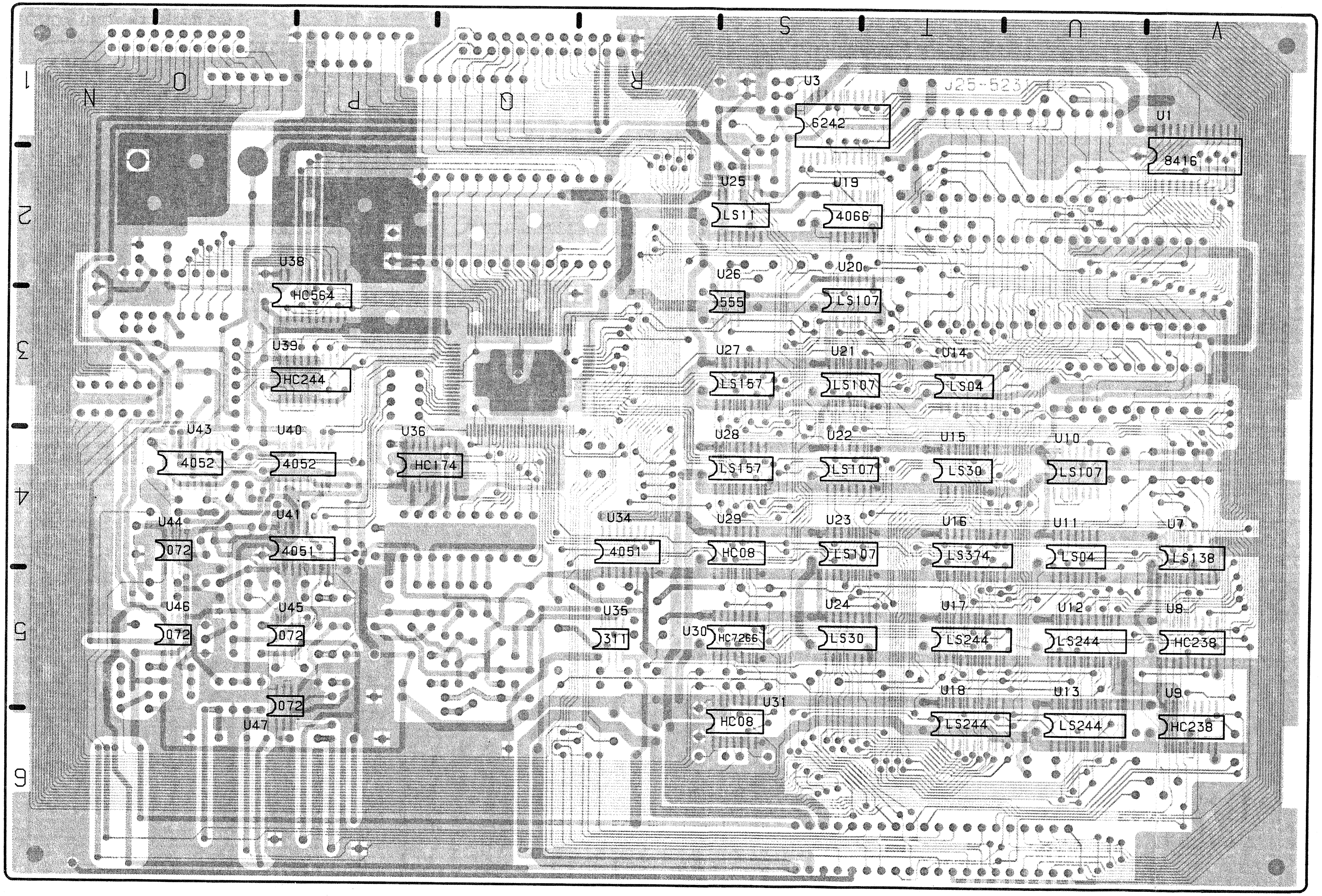
P.C BOARD

R/O UNIT (X77-1490-00)


X77-1490-00
P1
P2
P3
P4
6012
U37
CTM5020
U33
0808
U42
27C64
U32
PAL
U6
Z-80A
U5
27C128 (27C256)
U2
B1
+5V
X1
X2
A
B
C
D
E
F
G
H
I
1
2
3
4
5
6

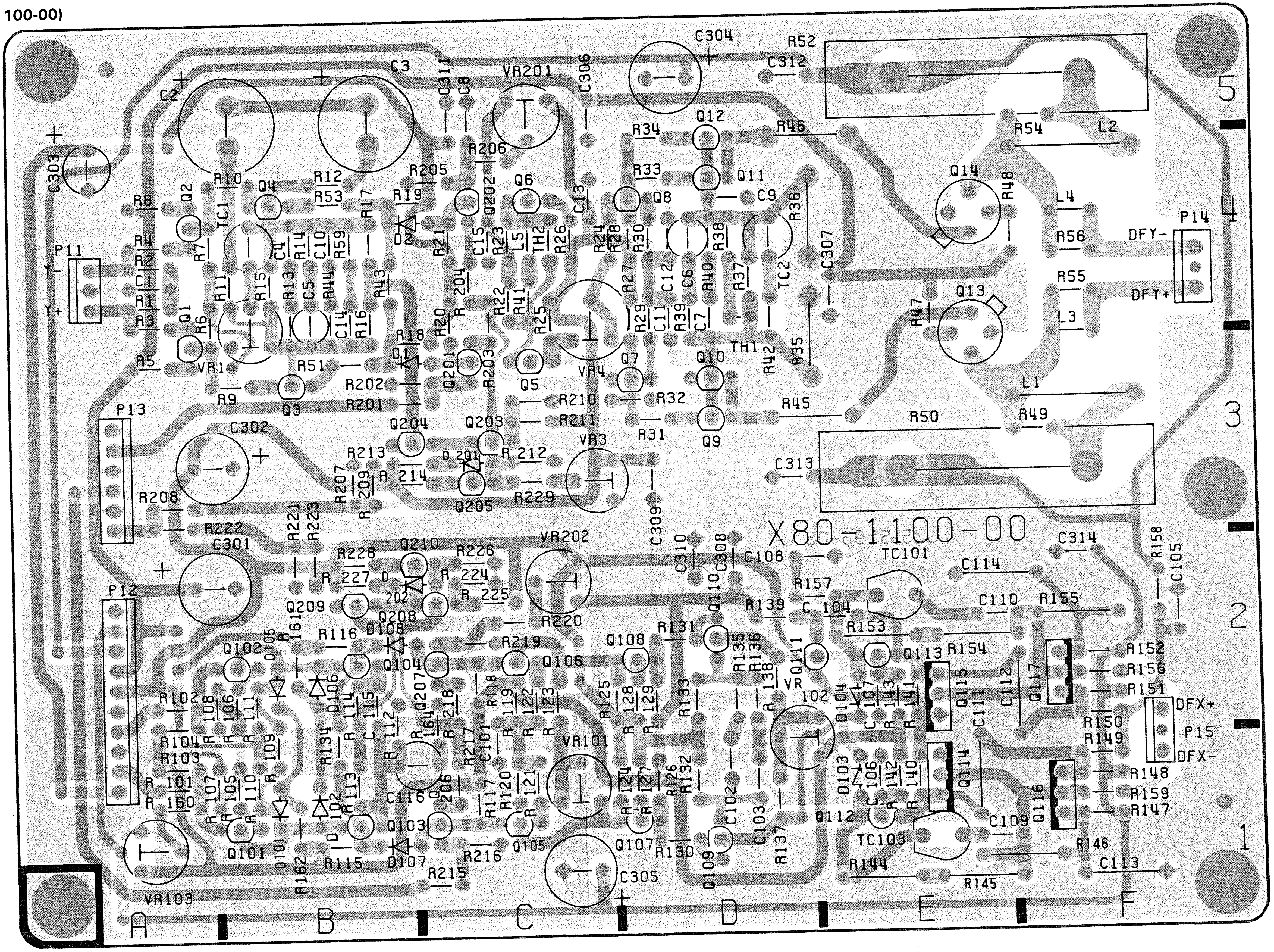
P.C BOARD

R/O UNIT (X77-1490-00)


N
O
P
Q
R
S
T
U
V
1
2
3
4
5
6
J25-523
U3
6242
U1
8416
U25
LS11
U19
4066
U26
555
U20
LS107
U27
LS157
U21
LS107
U14
LS04
U28
LS157
U22
LS107
U15
LS30
U10
LS107
U29
HC08
U23
LS107
U16
LS374
U11
LS04
U7
LS138
U30
HC7266
U24
LS30
U17
LS244
U12
LS244
U8
HC238
U31
HC08
U18
LS244
U13
LS244
U9
HC238
U38
HC564
U39
HC244
U43
4052
U40
4052
U36
HC174
U44
072
U41
4051
U34
4051
U46
072
U45
072
U35
311
U47
072

P.C BOARD

FINAL UNIT (X80-1100-00)



C304
R52
C312
C3
C2
C311
C8
VR201
C306
C303
R34
Q12
R46
R54
L2
R206
R33
Q11
Q14
R48
R10
Q4
R12
R205
Q202
Q6
C13
R8
Q2
R53
R17
R19
Q8
C9
R36
L4
TC1
R14
C10
R59
D2
R21
C15
R23
L5
TH2
R26
R24
R28
R30
R38
C307
R56
DFY-
P14
R4
R7
C4
R2
P11
Y-
C1
R1
Y+
R3
R11
R15
R13
C5
R44
R43
R22
R204
R41
R27
C12
C6
R40
R37
TC2
R55
DFY+
Q1
R6
C14
R16
R18
R20
R25
R29
C11
R39
C7
R47
Q13
L3
R5
VR1
R51
D1
Q201
R203
Q7
TH1
R42
R35
Q10
VR4
R9
Q3
R202
R201
Q5
R210
R32
R45
L1
R50
R49
P13
C302
Q204
Q203
R211
R31
Q9
VR3
R213
D201
R212
R214
R207
R209
Q205
R229
C313
R208
C309
R222
R221
R223
C301
R228
Q210
R226
VR202
C310
C308
C108
X80-1100-00
TC101
C314
R158
C105
C114
R227
D202
R224
R225
Q110
R157
C110
R155
P12
Q209
Q208
R220
R139
C104
R161
D105
Q102
R116
D108
R219
Q108
R131
R135
R136
R153
R154
Q113
Q111
R152
R156
Q104
Q106
D106
R118
R138
VR102
D104
C107
R143
R141
Q115
C112
Q117
R151
DFX+
R102
R108
R106
R111
R114
C115
Q207
R218
R119
R122
R123
R125
R128
R129
R133
C111
R150
P15
R104
R103
R109
R134
R112
R164
R217
C101
VR101
R149
DFX-
R101
R107
R105
R110
R160
R113
C116
Q206
R117
R120
R121
R124
R127
R126
R132
D103
C106
R142
R140
Q114
R148
R159
R147
Q116
D102
C102
C103
Q112
C109
Q101
D101
Q103
Q105
Q107
R130
Q109
R137
TC103
R146
R162
R115
D107
R216
R215
C305
R144
R145
C113
VR103
A
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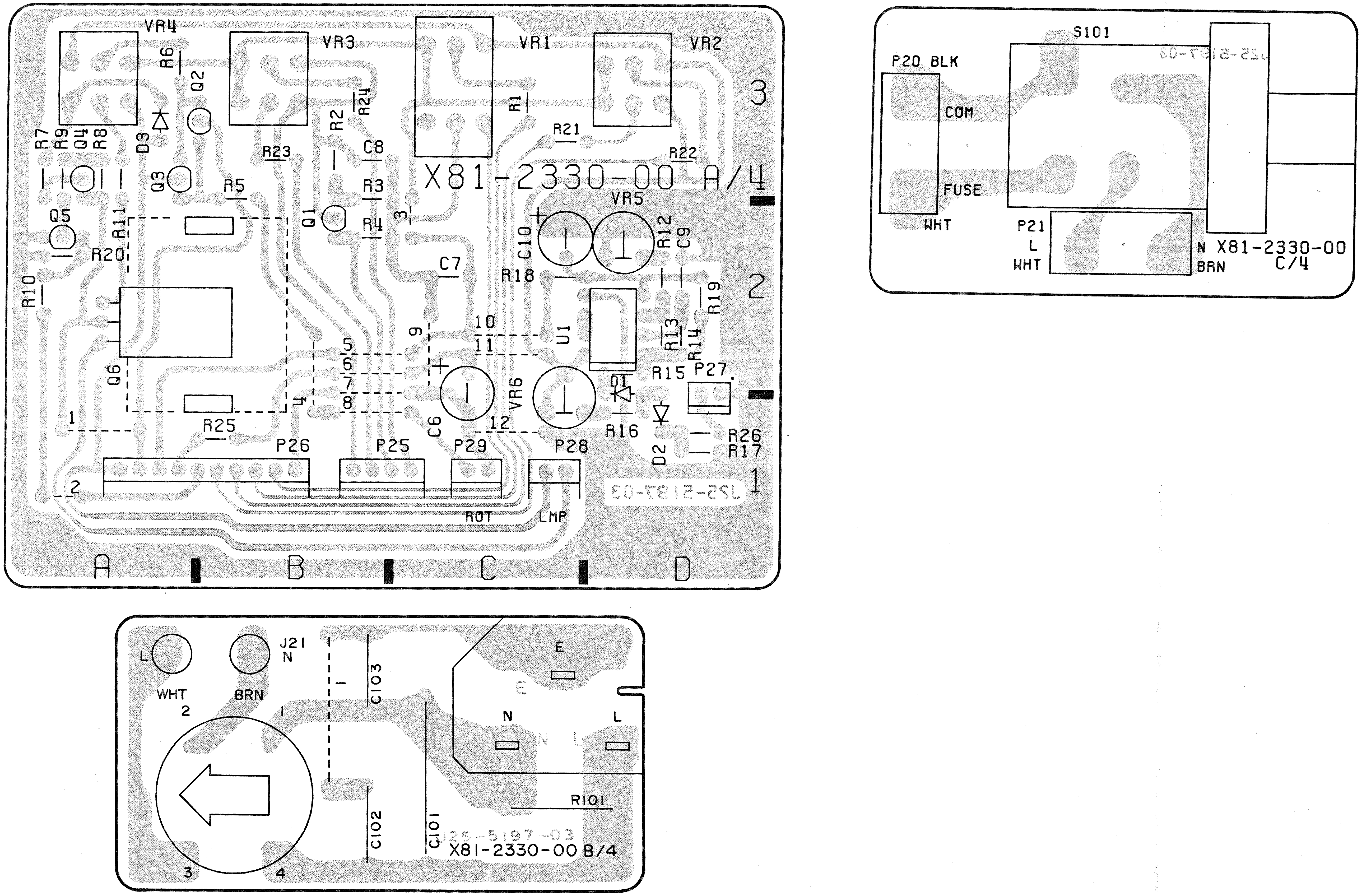
C
D
E
F
1
2
3
4
5

P.C BOARD

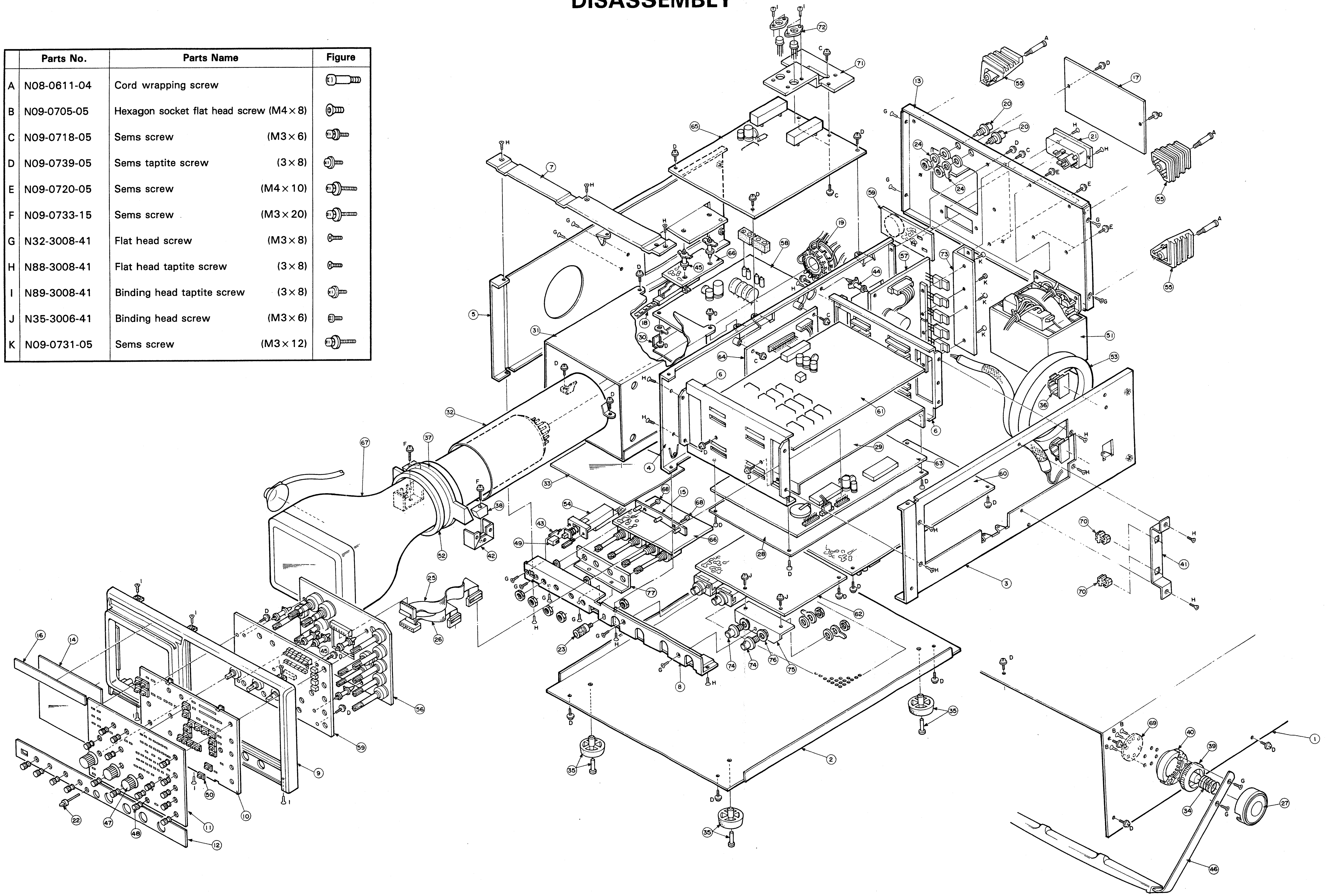
VOLUME UNIT (X81-2330-00)


VR4
VR3
VR1
VR2
VR5
VR6
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
Q1
Q2
Q3
Q4
Q5
Q6
D1
D2
D3
C6
C7
C8
C9
C10
U1
P25
P26
P27
P28
P29
ROT
LMP
1
2
3
4
5
6
7
8
9
10
11
12
X81-2330-00 A/4
A
B
C
D
S101
P20 BLK
COM
FUSE
WHT
P21
L
WHT
N
BRN
X81-2330-00 C/4
L
J21
N
WHT
BRN
2
1
3
4
C103
C102
C101
E
N
L
R101
X81-2330-00 B/4

Pattern side view

DISASSEMBLY

	Parts No.	Parts Name	Figure
A	N08-0611-04	Cord wrapping screw	
B	N09-0705-05	Hexagon socket flat head screw (M4×8)	
C	N09-0718-05	Sems screw (M3×6)	
D	N09-0739-05	Sems taptite screw (3×8)	
E	N09-0720-05	Sems screw (M4×10)	
F	N09-0733-15	Sems screw (M3×20)	
G	N32-3008-41	Flat head screw (M3×8)	
H	N88-3008-41	Flat head taptite screw (3×8)	
I	N89-3008-41	Binding head taptite screw (3×8)	
J	N35-3006-41	Binding head screw (M3×6)	
K	N09-0731-05	Sems screw (M3×12)	



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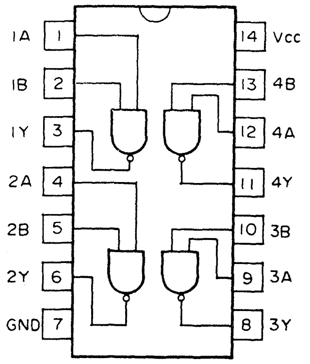
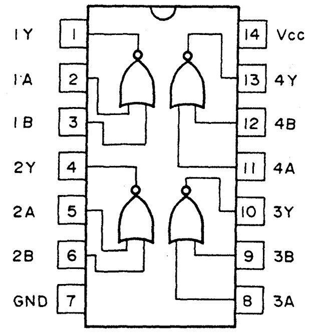
(74)
(75)
(76)
(77)
A
B
C
D
E
F
G
H
I
J
K

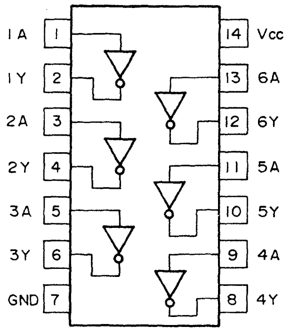
SEMICONDUCTORS


1A 1
1B 2
1Y 3
2A 4
2B 5
2Y 6
GND 7
14 Vcc
13 4B
12 4A
11 4Y
10 3B
9 3A
8 3Y

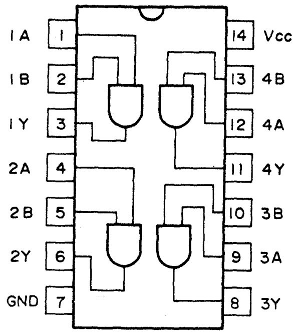
SN74ALS00AN


1Y 1
1A 2
1B 3
2Y 4
2A 5
2B 6
GND 7
14 Vcc
13 4Y
12 4B
11 4A
10 3Y
9 3B
8 3A

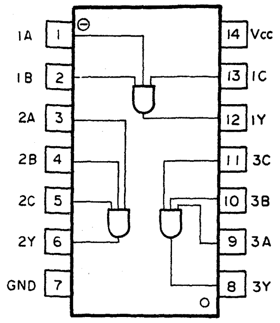
SN74ALS02N


1A 1
1Y 2
2A 3
2Y 4
3A 5
3Y 6
GND 7
14 Vcc
13 6A
12 6Y
11 5A
10 5Y
9 4A
8 4Y

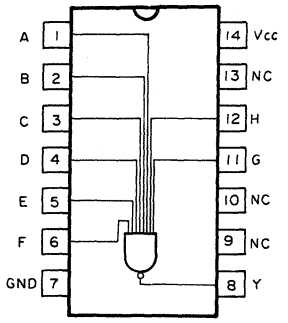
HD74LS04FP


1A 1
1B 2
1Y 3
2A 4
2B 5
2Y 6
GND 7
14 Vcc
13 4B
12 4A
11 4Y
10 3B
9 3A
8 3Y

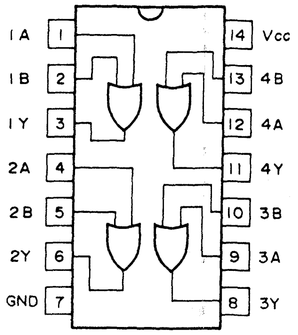
SN74ALS08N
HD74HC08FP


1A 1
1B 2
2A 3
2B 4
2C 5
2Y 6
GND 7
14 Vcc
13 1C
12 1Y
11 3C
10 3B
9 3A
8 3Y

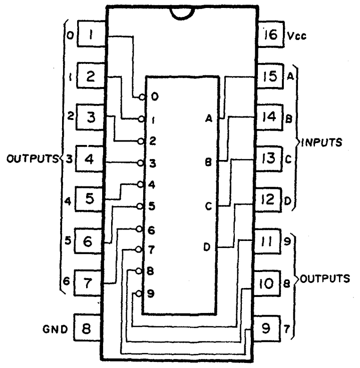
HD74LS11FP


A 1
B 2
C 3
D 4
E 5
F 6
GND 7
14 Vcc
13 NC
12 H
11 G
10 NC
9 NC
8 Y

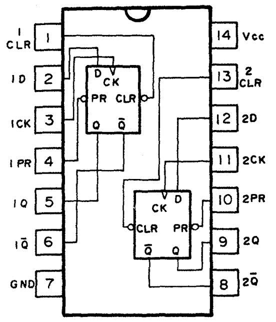
HD74LS30FP


1A 1
1B 2
1Y 3
2A 4
2B 5
2Y 6
GND 7
14 Vcc
13 4B
12 4A
11 4Y
10 3B
9 3A
8 3Y

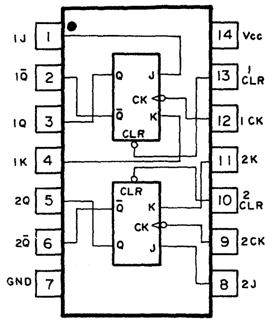
SN74ALS32N


0 1
1 2
2 3
OUTPUTS 3 4
4 5
5 6
6 7
GND 8
16 Vcc
15 A
14 B
13 C
12 D
INPUTS
11 9
10 8
9 7
OUTPUTS

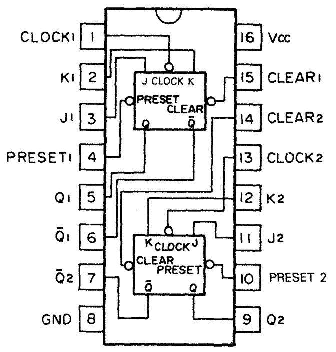
HD74LS42P


1 CLR 1
1D 2
1CK 3
1PR 4
1Q 5
1Q̄ 6
GND 7
14 Vcc
13 2 CLR
12 2D
11 2CK
10 2PR
9 2Q
8 2Q̄

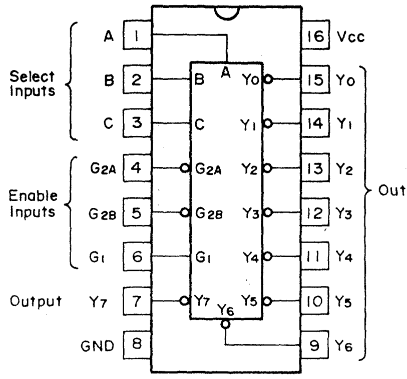
SN74ALS74AN


1J 1
1Q̄ 2
1Q 3
1K 4
2Q 5
2Q̄ 6
GND 7
14 Vcc
13 1 CLR
12 1 CK
11 2K
10 2 CLR
9 2CK
8 2J

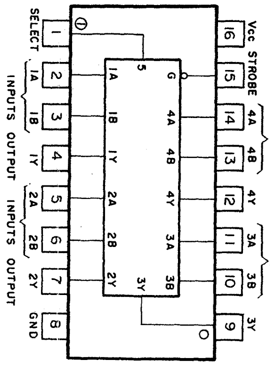
HD74LS107AFP
HD74HC107FP


CLOCK1 1
K1 2
J1 3
PRESET1 4
Q1 5
Q̄1 6
Q̄2 7
GND 8
16 Vcc
15 CLEAR1
14 CLEAR2
13 CLOCK2
12 K2
11 J2
10 PRESET 2
9 Q2

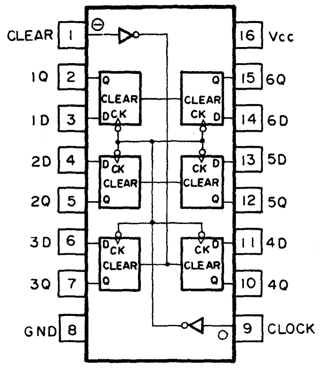
SN74ALS112AN


Select Inputs
A 1
B 2
C 3
Enable Inputs
G2A 4
G2B 5
G1 6
Output
Y7 7
GND 8
16 Vcc
15 Y0
14 Y1
13 Y2
12 Y3
11 Y4
10 Y5
9 Y6
Outputs

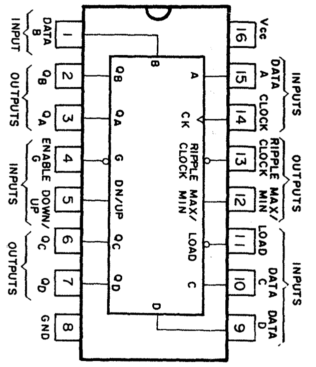
HD74LS138FP


SELECT 1
1A 2
1B 3
1Y 4
2A 5
2B 6
2Y 7
GND 8
16 Vcc
15 STROBE
14 4A
13 4B
12 4Y
11 3A
10 3B
9 3Y
INPUTS
OUTPUT

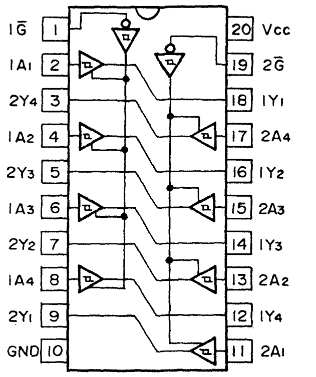
HD74LS157FP


CLEAR 1
1Q 2
1D 3
2D 4
2Q 5
3D 6
3Q 7
GND 8
16 Vcc
15 6Q
14 6D
13 5D
12 5Q
11 4D
10 4Q
9 CLOCK

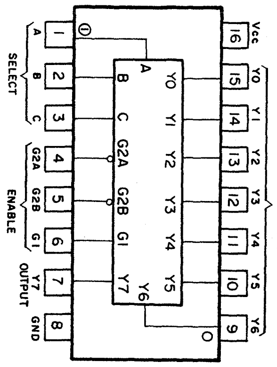
HD74HC174FP


DATA B INPUT 1
QB 2
QA 3
OUTPUTS
ENABLE G 4
DOWN/UP 5
QC 6
QD 7
OUTPUTS
GND 8
16 Vcc
15 DATA A
14 CLOCK
13 RIPPLE CLOCK
12 MAX/MIN
11 LOAD
10 DATA C
9 DATA D
INPUTS
OUTPUTS

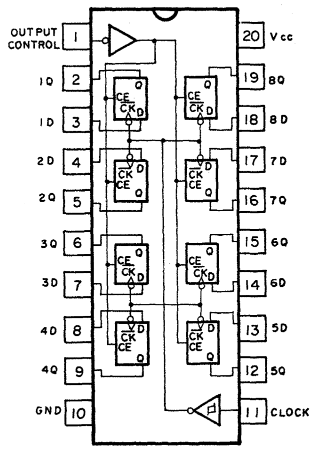
SN74ALS191N


1Ḡ 1
1A1 2
2Y4 3
1A2 4
2Y3 5
1A3 6
2Y2 7
1A4 8
2Y1 9
GND 10
20 Vcc
19 2Ḡ
18 1Y1
17 2A4
16 1Y2
15 2A3
14 1Y3
13 2A2
12 1Y4
11 2A1

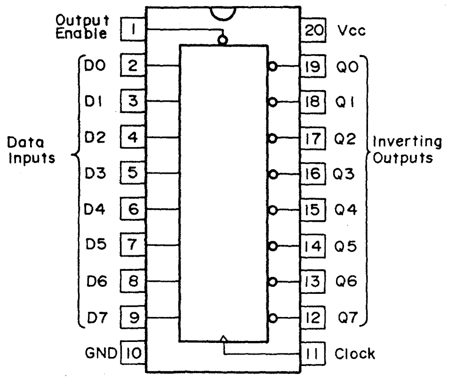
HD74LS244FP


SELECT
A 1
B 2
C 3
ENABLE
G2A 4
G2B 5
G1 6
OUTPUT
Y7 7
GND 8
16 Vcc
15 Y0
14 Y1
13 Y2
12 Y3
11 Y4
10 Y5
9 Y6
DATA OUTPUTS

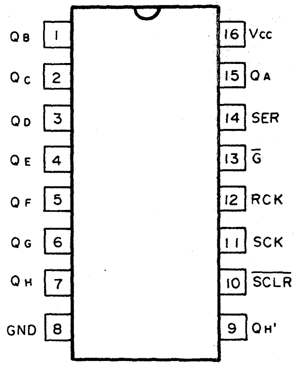
HD74LS374FP


OUTPUT CONTROL 1
1Q 2
1D 3
2D 4
2Q 5
3Q 6
3D 7
4D 8
4Q 9
GND 10
20 Vcc
19 8Q
18 8D
17 7D
16 7Q
15 6Q
14 6D
13 5D
12 5Q
11 CLOCK

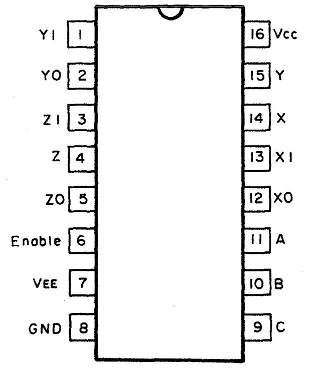
HD74HC238FP


Output Enable 1
Data Inputs
D0 2
D1 3
D2 4
D3 5
D4 6
D5 7
D6 8
D7 9
GND 10
20 Vcc
19 Q0
18 Q1
17 Q2
16 Q3
15 Q4
14 Q5
13 Q6
12 Q7
11 Clock
Inverting Outputs

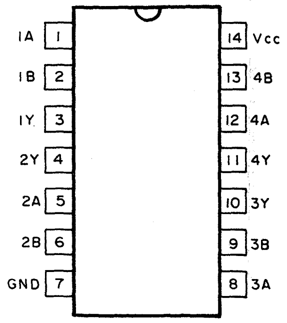
HD74HC564FP


QB 1
QC 2
QD 3
QE 4
QF 5
QG 6
QH 7
GND 8
16 Vcc
15 QA
14 SER
13 Ḡ
12 RCK
11 SCK
10 SCLR
9 QH'

HD74HC595P

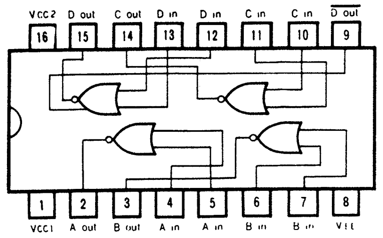

Y1 1
Y0 2
Z1 3
Z 4
Z0 5
Enable 6
VEE 7
GND 8
16 Vcc
15 Y
14 X
13 X1
12 X0
11 A
10 B
9 C

MC74HC4053N

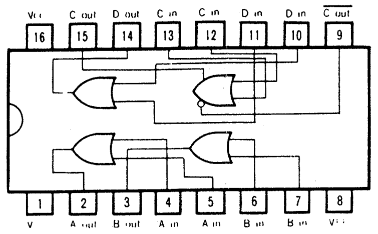

1A 1
1B 2
1Y 3
2Y 4
2A 5
2B 6
GND 7
14 Vcc
13 4B
12 4A
11 4Y
10 3Y
9 3B
8 3A

HD74HC7266FP

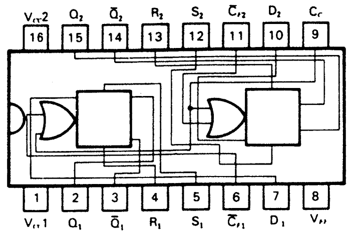
SEMICONDUCTORS


VCC2
D out
C out
D in
D in
C in
C in
$\overline{D}$ out
16
15
14
13
12
11
10
9
1
2
3
4
5
6
7
8
VCC1
A out
B out
A in
A in
B in
B in
VEE

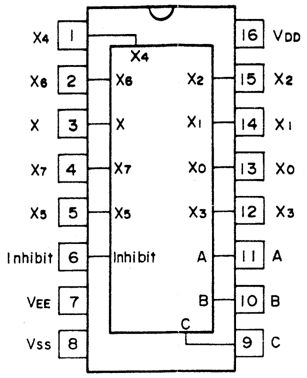
MC10H102L


Vcc
C out
D out
C in
C in
D in
D in
$\overline{C}$ out
16
15
14
13
12
11
10
9
1
2
3
4
5
6
7
8
V
A out
B out
A in
A in
B in
B in
VEE

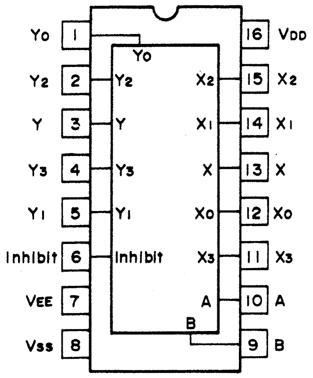
MC10103L


$V_{CC}2$
Q_2
$\overline{Q}_2$
R_2
S_2
$\overline{C}_{E2}$
D_2
C_C
16
15
14
13
12
11
10
9
1
2
3
4
5
6
7
8
$V_{CC}1$
Q_1
$\overline{Q}_1$
R_1
S_1
$\overline{C}_{E1}$
D_1
V_{EE}

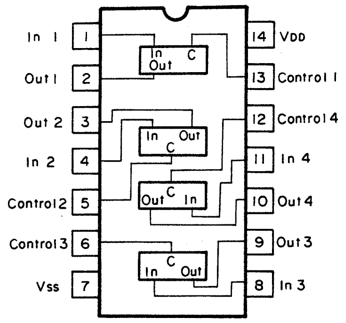
MC10H131L


X4
X6
X
X7
X5
Inhibit
VEE
Vss
1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9
VDD
X2
X1
X0
X3
A
B
C
X4
X6
X
X7
X5
Inhibit
X2
X1
X0
X3
A
B
C

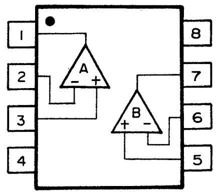
HD14051BFP


Y0
Y2
Y
Y3
Y1
Inhibit
VEE
Vss
1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9
VDD
X2
X1
X
X0
X3
A
B
Y0
Y2
Y
Y3
Y1
Inhibit
X2
X1
X
X0
X3
A
B

HD14052BFP
MC14052BCP

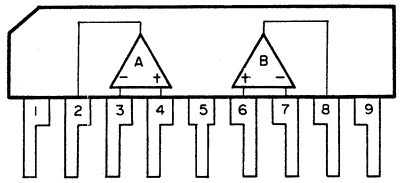

In 1
Out 1
Out 2
In 2
Control 2
Control 3
Vss
1
2
3
4
5
6
7
14
13
12
11
10
9
8
VDD
Control 1
Control 4
In 4
Out 4
Out 3
In 3
In
Out
C
In
Out
C
Out
C
In
In
C
Out

HD14066BFP


1
2
3
4
8
7
6
5
A
B
−
+
+
−

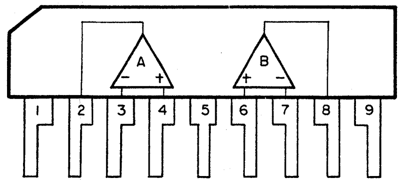
Pin name
1. A OUTPUT
2. A (−) INPUT
3. A (+) INPUT
4. V⁻
5. B (+) INPUT
6. B (−) INPUT
7. B OUTPUT
8. V⁺

NJM072M


A
B
−
+
+
−
1
2
3
4
5
6
7
8
9

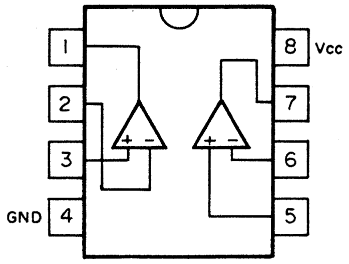
Pin name
1. V⁺
2. A OUTPUT
3. A (−) INPUT
4. A (+) INPUT
5. V⁻
6. B (+) INPUT
7. B (−) INPUT
8. B OUTPUT
9. V⁺

NJM072S

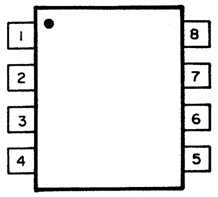

A
B
−
+
+
−
1
2
3
4
5
6
7
8
9

Pin name
1. V⁺
2. A OUTPUT
3. A − INPUT
4. A + INPUT
5. V⁻
6. B + INPUT
7. B − INPUT
8. B OUTPUT
9. V⁺

NJM4556S

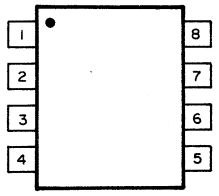

1
2
3
GND
4
8
Vcc
7
6
5
+
−
+
−

NJM4558D



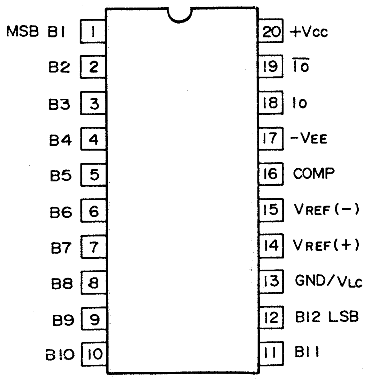
Pin name
1. GROUND
2. + INPUT
3. − INPUT
4. V⁻
5. BAL
6. BAL/STROBE
7. OUTPUT
8. V⁺

NJM311M

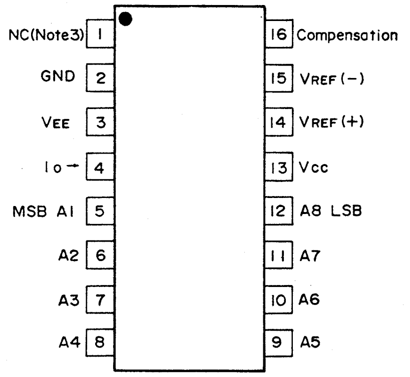


Pin name
1. GND
2. TRIGGER
3. OUTPUT
4. RESET
5. CONTROL VOLTAGE
6. SLESHHOLD
7. DISCHARGE
8. V⁺

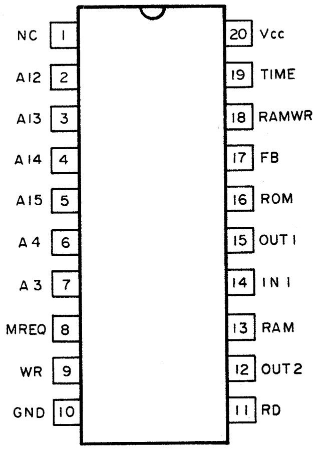
NJM555M


MSB B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
1
2
3
4
5
6
7
8
9
10
20
19
18
17
16
15
14
13
12
11
+Vcc
$\overline{\text{Io}}$
Io
−VEE
COMP
VREF (−)
VREF (+)
GND/VLC
B12 LSB
B11

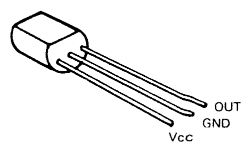
AM6012DC


NC(Note3)
GND
VEE
Io →
MSB A1
A2
A3
A4
1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9
Compensation
VREF (−)
VREF (+)
Vcc
A8 LSB
A7
A6
A5

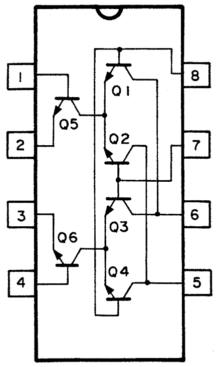
DAC0808LCN


NC
A12
A13
A14
A15
A4
A3
MREQ
WR
GND
1
2
3
4
5
6
7
8
9
10
20
19
18
17
16
15
14
13
12
11
Vcc
TIME
RAMWR
FB
ROM
OUT 1
IN 1
RAM
OUT 2
RD

DTM-5010

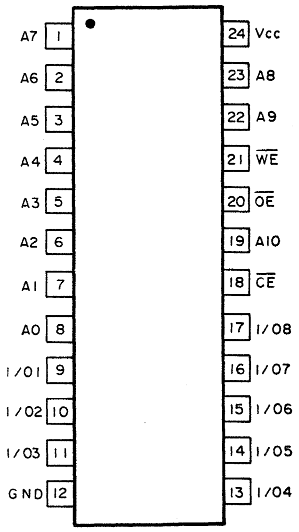


PST518B


1
2
3
4
8
7
6
5
Q1
Q2
Q3
Q4
Q5
Q6

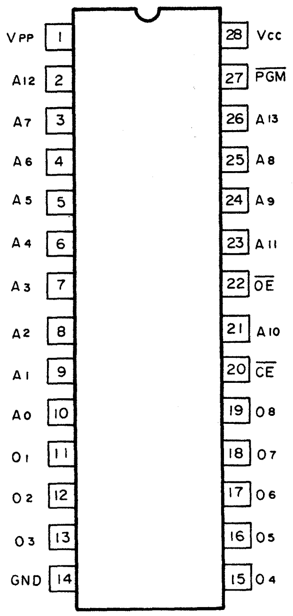
μPA101G

SEMICONDUCTORS



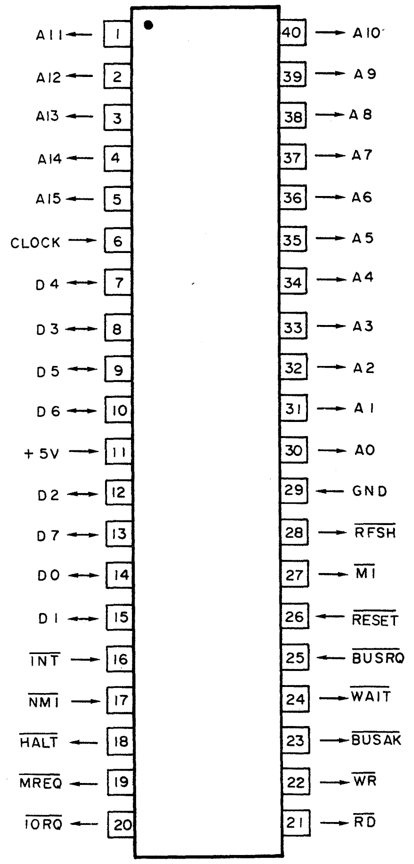
A7 1
A6 2
A5 3
A4 4
A3 5
A2 6
A1 7
A0 8
I/O1 9
I/O2 10
I/O3 11
GND 12
24 Vcc
23 A8
22 A9
21 $\overline{WE}$
20 $\overline{OE}$
19 A10
18 $\overline{CE}$
17 I/O8
16 I/O7
15 I/O6
14 I/O5
13 I/O4

LC3517BML-15



VPP 1
A12 2
A7 3
A6 4
A5 5
A4 6
A3 7
A2 8
A1 9
A0 10
O1 11
O2 12
O3 13
GND 14
28 Vcc
27 $\overline{PGM}$
26 A13
25 A8
24 A9
23 A11
22 $\overline{OE}$
21 A10
20 $\overline{CE}$
19 O8
18 O7
17 O6
16 O5
15 O4

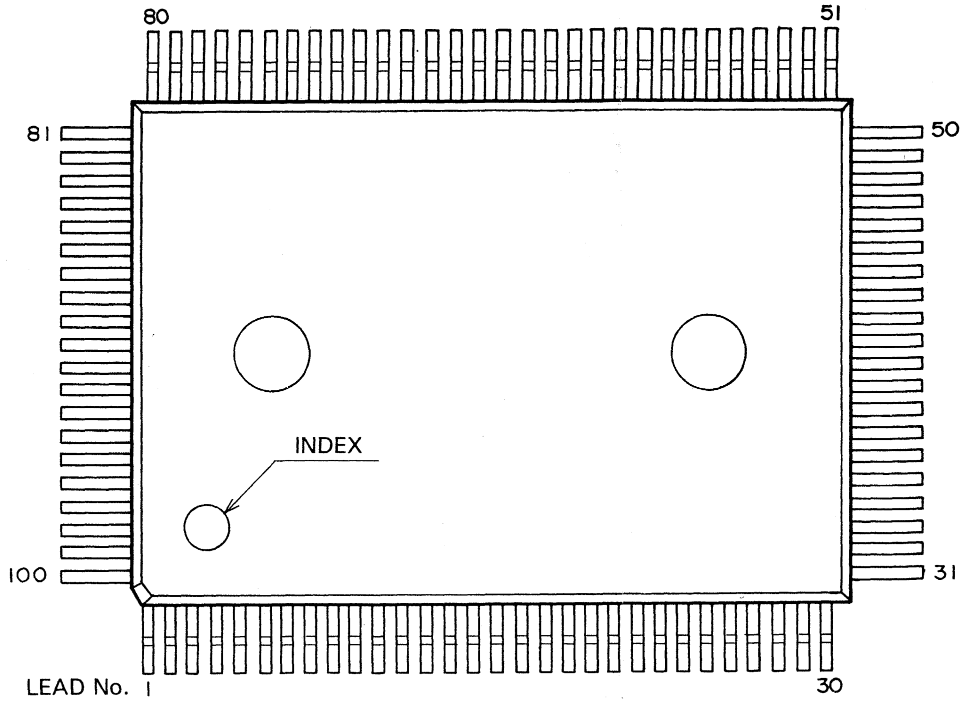
MBM27C128＊S



A11 1
A12 2
A13 3
A14 4
A15 5
CLOCK 6
D4 7
D3 8
D5 9
D6 10
+5V 11
D2 12
D7 13
D0 14
D1 15
$\overline{INT}$ 16
$\overline{NMI}$ 17
$\overline{HALT}$ 18
$\overline{MREQ}$ 19
$\overline{IORQ}$ 20
40 A10
39 A9
38 A8
37 A7
36 A6
35 A5
34 A4
33 A3
32 A2
31 A1
30 A0
29 GND
28 $\overline{RFSH}$
27 $\overline{M1}$
26 $\overline{RESET}$
25 $\overline{BUSRQ}$
24 $\overline{WAIT}$
23 $\overline{BUSAK}$
22 $\overline{WR}$
21 $\overline{RD}$

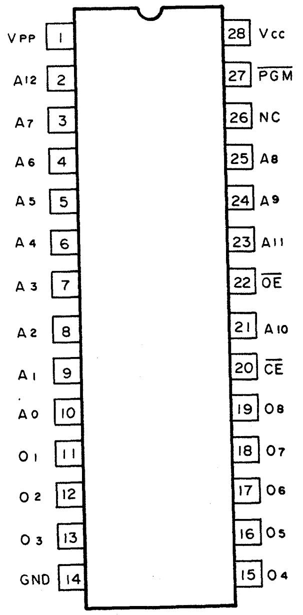
LH0080A

CTM5020



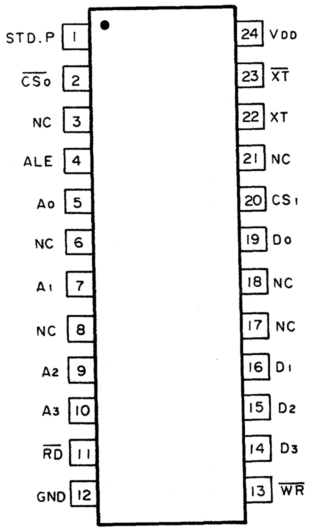
80
51
81
50
INDEX
100
31
LEAD No. 1
30

Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	CONT	26	TSD0	51	GETD	76	DD3
2	A13	27	TSD1	52	CA0	77	SING
3	VDD	28	VDD	53	VDD	78	VDD
4	A14	29	TSD2	54	CA4	79	R10M
5	A15	30	AX2	55	CA3	80	10M
6	INT0	31	AX1	56	CA2	81	HLDF
7	VX3	32	AX0	57	CA1	82	SGA
8	VX2	33	AX3	58	CD3	83	ROSP
9	VX1	34	HS2	59	CD2	84	ROD
10	VX0	35	HS1	60	CD4	85	HLDL
11	DA0	36	TDIO	61	CD1	86	ROUB
12	DA1	37	TWE	62	CD5	87	ROB
13	DA2	38	TCK1	63	DC4	88	ROQ
14	DA3	39	TST1	64	CD7	89	ROED
15	VSS	40	VSS	65	VSS	90	VSS
16	DA4	41	TST2	66	DC3	91	D7
17	DA5	42	TADD	67	DC2	92	D5
18	DA6	43	TCK2	68	CD6	93	D3
19	DA7	44	VS2	69	DC1	94	D1
20	DA8	45	VS1	70	DC0	95	ALE
21	DA9	46	VA0	71	CD0	96	D6
22	ROR	47	VA4	72	DD7	97	D4
23	ROA	48	VA3	73	DD6	98	D2
24	LEVX	49	VA2	74	DD5	99	D0
25	TCL	50	VA1	75	DD4	100	WR



VPP 1
A12 2
A7 3
A6 4
A5 5
A4 6
A3 7
A2 8
A1 9
A0 10
O1 11
O2 12
O3 13
GND 14
28 Vcc
27 $\overline{PGM}$
26 NC
25 A8
24 A9
23 A11
22 $\overline{OE}$
21 A10
20 $\overline{CE}$
19 O8
18 O7
17 O6
16 O5
15 O4

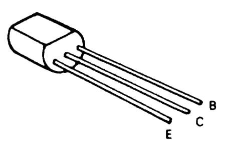
MBM27C64＊U



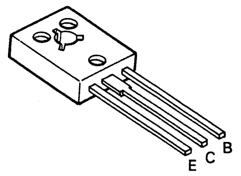
STD.P 1
$\overline{CS0}$ 2
NC 3
ALE 4
A0 5
NC 6
A1 7
NC 8
A2 9
A3 10
$\overline{RD}$ 11
GND 12
24 VDD
23 $\overline{XT}$
22 XT
21 NC
20 CS1
19 D0
18 NC
17 NC
16 D1
15 D2
14 D3
13 $\overline{WR}$

MSM6242BGS-VK

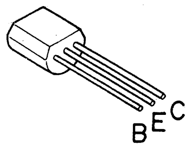
SEMICONDUCTORS



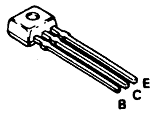
2SA684 (Q)
2SA1208 (S, T)
2SC2271 (D)
2SC2910 (S, T)
2SC1384 (R, S)



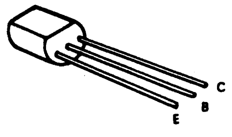
2SA1209 (S, T)
2SA1406 (E, F)
2SC2911 (S, T)
2SC3600 (E, F)



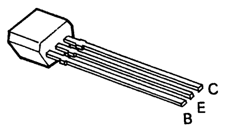
2SA1161
2SC3779 (D)



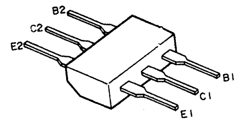
2SA1175 (E)
2SC2785 (F)
2SC3732 (L)



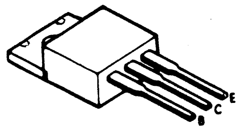
2SA1206



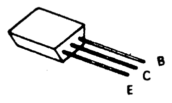
2SA1565
2SC4049


B2
C2
E2
B1
C1
E1

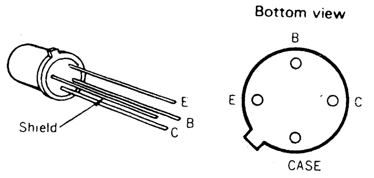
2SC4072
2SC3066 (F)



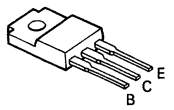
2SB1133 (S)
2SD1666 (S)



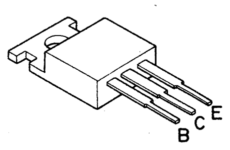
2SC3354 (T, S)


Bottom view
B
E
C
CASE
Shield
E
B
C

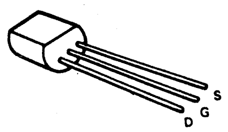
2SC1164 (O)＊S



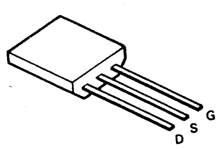
2SD1409



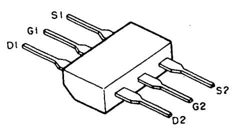
2SD613 (E)



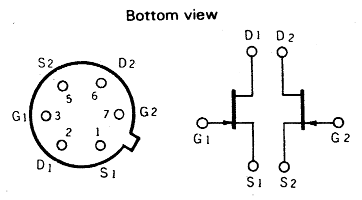
2SK583



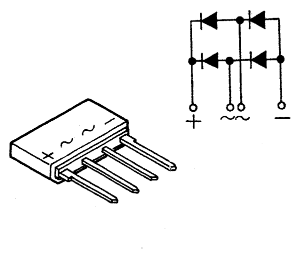
2SK241 (GR)


S1
G1
D1
S2
G2
D2

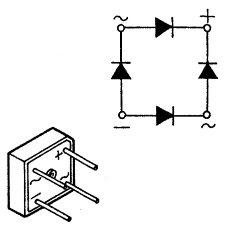
2SK332 (F)


Bottom view
S2
D2
G1
G2
D1
S1
5
6
3
7
2
1
D1
D2
G1
G2
S1
S2

DN1901



S1VB60



S4VB40F

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